Not a proper mathematician, like those with a mathematics degree: ‘Subject switchers’ negotiating identities as beginning teachers of mathematics.

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A thesis submitted in partial fulfilment of the requirements of the University of Wolverhampton for the degree of Doctor of Education

April 2020

This work or any part thereof has not previously been presented in any form to the University or to any other body whether for the purposes of assessment, publication or for any other purpose (unless otherwise indicated). Save for any express acknowledgements, references and/or bibliographies cited in the work, I confirm that the intellectual content of the work is the result of my own efforts and of no other person.

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Date 22/04/2020

Abstract

In the context of a shortage of teachers of mathematics, the introduction of subject knowledge enhancement (SKE) courses has widened participation in initial teacher training (ITT) to include graduates of non-mathematical disciplines.

In the absence of a term in the literature, the term 'subject switcher' is introduced to represent those whose degree is in a discipline that is not directly related to the subject they are training to teach. In the context of this study, a subject switcher is a participant in mathematics initial teacher training whose degree is in a non-mathematical discipline. This study explores how being a subject switcher might influence the negotiation of identities as a teacher of mathematics.

Four participant stories were constructed, from a range of narrative sources, to explore individual journeys to becoming a qualified teacher of mathematics. The subject switchers participating in this study had a range of incoming identities, including existing mathematical identities as well as alternative subject identities from the discipline of their degree studies.

The theoretical framework of learning and identity construction within communities of practice (Lave and Wenger, 1991; Wenger, 1998) was used to consider the identities of the participants, drawing on a framework developed from Wenger's (1998) notion of trajectories. The incoming, transitioning and future-orientated identities of the participants are explored in the context of their trajectories and the communities of practice in which they participate.

The findings reveal that the participants relied upon their incoming identities as they negotiated identities as teachers of mathematics. This negotiation of identities

included their mathematical identities but, particularly, how they viewed themselves as mathematics teachers compared to those who were mathematics graduates.

This study concludes that teacher educators should explore more inclusive strategies to support subject switchers to negotiate mathematical identities in becoming a teacher of mathematics.

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Acknowledgements

I am indebted to my Director of Studies, Dr David Matheson, for all of the encouragement, guidance and support he has provided to enable the completion of this thesis. My sincere thanks also go to Dr Zeta Williams-Brown, for her support as my second supervisor; Dr Linda Devlin, who has provided ongoing guidance and support throughout my doctoral journey; and to the many other colleagues who have provided me with opportunity, encouragement and support.

I would like to give a very special thank you to the four beginning teachers who participated in this study, for sharing their personal stories with me. I am delighted that the subject knowledge enhancement (SKE) course provided the opportunity for these passionate and dedicated individuals to become teachers of mathematics.

I must acknowledge my colleague and friend, John Brooman, whose vision and ambition for the mathematics enhancement course (MEC) made it possible for so many ‘subject switchers’ to become teachers of mathematics over the last decade, not forgetting my other mathematics colleagues who have carried this legacy forward.

Finally, I wish to acknowledge the significant patience and support of my family throughout this long journey: my children, Jessica and Jack, have come to learn over the years that they will most likely find ‘mom’ in the study, ‘just doing a little bit on my thesis’; my Husband, Paul, has listened (again and again), always ‘fixed’ everything and, most importantly, ensured that the children have not been neglected; my parents and my in-laws for their support with childcare and, in particular, my Dad for his unfaltering encouragement.

Chapter 1: Introduction

1.1 Introduction to the chapter

This introductory chapter sets out the context, aims and justification of this study. It also includes a rationale for the research questions, including the potential contribution to research, and an overview of the structure of the thesis.

This study is concerned with understanding the identities of beginning teachers of secondary mathematics and how this might inform initial teacher training (ITT) strategies, in the context of a national shortage of specialist teachers of this subject.

> Perceived underperformance in mathematics in Britain is seen to be linked to a shortage in the supply of appropriately trained mathematics teachers. In the last decade there have been various initiatives in the UK to tackle the shortage of mathematics teachers, including: financial incentives for mathematics trainees linked to their degree classification (Warburton, 2014); government-funded opportunities for students to follow a subject knowledge enhancement course (SKE) prior to embarking on initial teacher education programmes (pre-ITT SKE); funded in-service training programmes aimed at non-specialist teachers of mathematics (post-ITT SKE). (Stevenson, 2017, p. 143)

This study focuses in particular on graduates of non-mathematical disciplines who train to become teachers of secondary mathematics via an alternative route of a pre-ITT subject knowledge enhancement (SKE) course. The absence of a term in the literature to refer to subject enhancement course participants, as non-traditional participants in initial teacher training, leads to the introduction of the term ‘subject switcher’ (section 1.6).

1.2 The national context

The supply and quality of teachers of mathematics has been of national concern over recent decades. The Cockcroft Report (Cockcroft, 1982), *Mathematics Counts,* identified concerns regarding the recruitment and retention of secondary school mathematics teachers, the quality of mathematics teaching in schools and the subject knowledge of beginning teachers.

> The shortage of well-qualified teachers of mathematics in secondary schools has increased considerably throughout the 1970s both as a result of the increasing number of pupils in schools and also of increasing demand for mathematicians in industry and commerce. (Cockcroft, 1982, p. 188)

The shortage of mathematicians and scientists has not been a challenge to the teaching profession alone. In response to concerns over the supply of scientists and engineers, the UK government commissioned a review into the supply of graduates with science, technology, engineering and mathematical skills. The Roberts Review (Roberts, 2002), *SET for Success*, reported findings relating to the difficulties faced by employers in recruiting appropriately qualified scientists and engineers. Roberts (2002) suggested the main reasons to be the 'significant falls in the numbers taking physics, mathematics, chemistry and engineering qualifications' (p. iii) and the significantly increased demand for graduates in mathematically orientated subjects. The shortage of graduates in these subjects has had an acute impact on the supply of teachers, where suitably qualified prospective candidates have 'other more attractive and better paid opportunities' to work in other fields (p. 4).

Following the Robert's Review, the Smith Report into post-14 mathematics education, *Making Mathematics Count*, identified the shortage of specialist mathematics teachers as 'the most serious problem we face' when looking to ensure

that children in schools develop the required mathematical skills, suggesting that, at that time, the maintained system in England was short of '3,400 specialist mathematics teachers' (Smith, 2004, p.4). Smith calculated that in order to solve this recruitment problem, 40 per cent of all mathematics graduates would need to be recruited to teacher training for 'the next several years' (p. 5). The Smith Report identified the need to 'look beyond the pool of mathematics graduates' by targeting graduates from a 'wider range of non-mathematics degree backgrounds' and deepen their understanding of mathematics prior to commencing an ITT course (p. 46).

The Department for Education and Skills (DfES, 2004) acknowledged in response to Smith (2004) that action needed to be taken to ensure an adequate supply of 'suitably qualified' mathematics teachers now and in the future, in response to three key challenges:

- the high percentage of mathematics teachers approaching retirement age;
- the relatively small proportion of students continuing to study mathematics at university; and
- the intense competition in the labour market for young people with high-level skills in mathematics. (DfES, 2004, pp. 9-10)

In response to the recommendations in the Smith Report (Smith, 2004), the DfES initiated the roll-out of the government-funded subject enhancement course pilot for 'prospective trainee teachers of mathematics who do not have a mathematics degree' (DfES, 2004, p. 24). These six-month intensive courses were designed for 'prospective specialists' in the subjects where recruitment remains the 'most difficult' (DfES, 2002). The aim of subject enhancement courses was to increase the pool of graduates eligible to train as teachers in the subjects that were needed the most, 'in the face of competition from other careers' (McNulty, 2004). Subject enhancement courses enabled those 'without appropriate existing mathematics qualifications'

(Smith, 2004, p. 5) to gain the subject knowledge and understanding required to train to teach the subject.

Whilst Smith (2004) acknowledged concerns that subject enhancement course schemes would attract entrants to ITT courses without the traditionally required mathematics qualifications and with 'varying levels of mathematical knowledge' (p. 6), he suggested adding those undertaking a pre-ITT mathematics enhancement course to the good or acceptable 'categories of qualifications of teachers used in the Cockcroft report' (Smith, 2004, pp. 19-20).

Subject enhancement courses have been recognised as being successful in providing 'an alternative route into teaching which is on a par with traditional entry teacher training and supporting the supply and quality of teachers into the profession' (Gibson et al., 2013, p. 16). Warburton (2015) calculated that 'over a third' of mathematics Postgraduate Certificate in Education (PGCE) students in England in 2010/11 had taken a subject enhancement course prior to commencing their teacher training (p. 8) and Stevenson (2017, p. 144) suggests that now possibly 'almost a half' of postgraduate trainee teachers do so.

This study is concerned with understanding the identities of those who take a subject enhancement course, as an alternative route to teaching, at a particular Higher Education Institution.

1.3 The context of the study

The context for this research is a post-1992 university in the West Midlands that has an established reputation as a provider of initial teacher education (ITE). The term 'initial teacher education' is deliberately used here, rather than 'initial teacher

training' as used in the government documentation and reports. This is because it is the philosophy of the provider to educate, rather than simply train teachers.

The University's mission is to maximise opportunities for students and for the geographical regions in which it operates. This involves social mobility, employability and the raising of academic standards to support the economic and social needs of the region and to narrow the skills gap in the communities served. An important aspect of this is supporting schools to raise the attainment and aspirations of young people in the region. This cannot be achieved without a supply of quality teachers in schools, in the subjects that are needed most, and hence the University's commitment to teacher education and the supply of suitably qualified teachers.

The University offered a mathematics enhancement course (MEC), later to be re-launched by the erstwhile Training and Development Agency (TDA) as a subject knowledge enhancement (SKE) course, for over a decade. The term *subject enhancement course* is used throughout this study to refer to pre-ITT courses that aim to develop subject knowledge for teaching, including both MEC and SKE courses. Subject enhancement courses have supported recruitment to ITE, as well as supporting the wider aims of the University, in particular raising the attainment and aspirations of local people. These courses have played a significant role in the recruitment to mathematics ITE at this institution with a significant number of student teachers coming through this route and qualifying as teachers of mathematics. Hence, subject enhancement courses have been successful in widening participation in mathematics ITE by providing an alternative route for graduates of non-mathematical disciplines to train to be teachers of mathematics.

1.4 My positioning

My personal biography also influences the context of this research. I was a teacher of secondary school mathematics prior to becoming the Subject Leader for Secondary Mathematics Education at a West Midlands higher education institution. Having been a teacher educator for over fifteen years, and as the current Head of Department for Secondary Education at the same higher education institution, my research interests have focused on the supply and quality of teachers. The recruitment and retention of teachers in national shortage subjects, in particular mathematics, has been a focus.

1.5 The aims of the research

The introduction of subject enhancement courses has changed the profile of those entering mathematics ITT by widening participation to graduates who do not hold the mathematics qualifications traditionally required for training to teach the subject, in particular a degree in mathematics. These courses have been of interest to graduates of non-mathematical disciplines, including career changers who wish to retrain to teach secondary mathematics (Gibson et al., 2013).

> [Subject enhancement courses are] opening up mathematics in general, and mathematics teaching in particular, to a greater diversity of people – with a range of qualifications and cultural backgrounds. This creates a need to consider the various identities that people come in with and how this shapes what is possible for them… We also have to ask what our role is as mathematics educators in intervening and supporting this process. (Hossain, Mendick and Adler, 2013, p. 46)

The aim of this study is to understand the journeys of subject enhancement course participants, as non-traditional participants in ITT, as they negotiate identities as beginning teachers of mathematics.

The theoretical framework of learning and identity construction within communities of practice (Lave and Wenger, 1991; Wenger, 1998) was used to consider the transitioning identities of subject enhancement course participants, as they negotiate being a graduate of an alternative subject and a returner or 'novice' to learning mathematics. A community of practice is defined by Lave and Wenger as 'a set of relations amongst persons, activity, and the world, over time and in relation with other tangential and overlapping communities of practice' (Lave and Wenger, 1991, p.98). Hence, a subject enhancement course is a community of practice focused on subject knowledge development for teaching. Likewise, an ITT course consists of communities of practice focused on pedagogical development for teaching the subject.

Wenger (1998) defines identity as 'a way of talking about how learning changes who we are and creates personal histories of becoming in the context of our communities' (p. 5) and as something that we 'constantly renegotiate during the course of our lives' (p. 154). According to Wenger, we take multiple paths that lead to the negotiation of new identities. He refers to these paths as 'trajectories' and identifies five types. Wenger states that the term trajectory does not suggest 'a path that can be foreseen or charted but a continuous motion – one that has a momentum of its own in addition to a field of influence. It has a coherence through time that connects the past, the present, and the future' (1998, p.154).

Grier and Johnston's (2012) study in the United States of career-changing STEM (science, technology, engineering and mathematics) professionals entering teaching applied Wenger's trajectories to conceptualise the career-changers' pathway to teaching. They claim that it is 'important to understand how career changers negotiate their past and potential futures' in the process of becoming teachers (Grier

and Johnston, 2012, p.23). In this study, Grier and Johnston's (2012) conceptualisation is adapted to consider how Wenger's notion of trajectories applies to graduates of non-mathematical disciplines on an alternative pathway to teaching, via a subject enhancement course. This developed framework was used for conceptualising how these non-traditional participants negotiate transitioning identities, from being graduates of alternative subjects to becoming qualified teachers of mathematics.

This study is concerned with understanding the transitioning identities of graduates of non-mathematical disciplines on their journey to becoming teachers of secondary mathematics.

1.6 Introduction of the term 'subject switcher'

A qualified teacher who is teaching a subject other than the one they trained to teach may be considered to be teaching 'out-of-field' (Ingersoll, 1999; Hobbs, 2013) or referred to as 'a non-specialist teacher' (Crisan and Rodd, 2017).

> A non-specialist teacher of mathematics is a school teacher who qualified to teach in a subject other than mathematics yet teaches mathematics to students in secondary school. (Crisan and Rodd, 2017, p. 104)

Crisan and Rodd's use of the term 'non-specialist teacher of mathematics' draws on the terminology used in the government literature on the supply of teachers (2017, p. 106). Whilst a 'non-specialist teacher' is a widely used term in teaching, there is no term offered in the teacher education literature for prospective specialists who train to teach a subject that is not directly related to the subject specialism of their degree. In the absence of an existing term, this thesis seeks to offer one.

Just as a participant entering teaching having had an alternative career may be termed a 'career changer' (Williams, 2010) or a 'career switcher' (Mayotte, 2003), it

seems logical that participants entering initial teacher training with an alternative subject specialism may be referred to as a 'subject switcher'. Hence just as a career changer switches career, 'subject switchers' are switching their subject specialism.

The following definition of a subject switcher is introduced in this thesis:

> A subject switcher is a participant in initial teacher training whose degree is in a discipline that is not directly related to the subject they are training to teach.

In particular, in the context of this study:

> A subject switcher is a participant in mathematics initial teacher training whose degree is in a non-mathematical discipline.

In most cases 'subject switchers' would participate in a subject enhancement course prior to embarking on their initial teacher education (ITE) course. This may not always be the case however. As Warburton's (2013) study identified, some candidates without degrees in mathematics do not take a subject enhancement course prior to initial teacher training and some candidates with a mathematics degree do take a subject enhancement course, particularly if some time has passed since their subject study.

Hence, this study is concerned with understanding the transitioning identities of 'subject switchers' on their journey to becoming qualified teachers of secondary mathematics.

1.7 The research questions

The introduction of subject enhancement courses and the resulting widening of participation in mathematics ITT to graduates of non-mathematical disciplines, to be referred to throughout this thesis as 'subject switchers', led me to ask the following research question:

How does being a subject switcher influence the negotiation of identities as a teacher of mathematics?

In attempting to answer this overarching research question, I considered the following three sub-questions:

1 What are the incoming identities of subject switchers embarking on a pre-initial teacher education subject enhancement course?
2 What identities do subject switchers negotiate during the subject enhancement course and initial teacher education?
3 What are the future-orientated identities of subject switchers as teachers of mathematics?

The changing profile of participants in mathematics ITE, and my interest in the quality and supply of teachers, led to the formulation of the research questions. The overarching aim of the study was to explore how being a subject switcher might influence the negotiation of identities as a beginning teacher of mathematics. The research sub-questions (RSQs) were designed to capture the contextual information required to answer this question.

Research sub-question 1 (RSQ1) is concerned with identifying the 'incoming identities' (Friedrichsen et al., 2008) of the participants. Throughout this study, the term 'incoming identities' refers to the prior and existing identities of the participants as they embark on a pre-ITE SKE course. It is recognised that professional identity cannot be separated from social identity as 'no one dimension may be understood singularly; it can be understood only in relation to the other dimensions' (Jones and McEwen, 2000, p. 410). Hence, potential incoming identities may be related to social or professional dimensions of identity.

Research sub-question 2 (RSQ2) explores the identities that subject switchers negotiate during the subject knowledge enhancement course and mathematics initial

teacher education. This question is concerned with transitioning identities and how subject switchers negotiate these, in the communities of practice to which they belong, on their journey to becoming qualified teachers of mathematics. For graduates of non-mathematical disciplines training to be teachers of mathematics, transitioning identities may include both teacher identities and mathematical identities.

Research sub-question 3 (RSQ3) explores the 'future-orientated' identities of the participants that Lutovac and Kaasila (2014) present as how 'teachers are anticipating their possible future identities as mathematics teachers within their narratives' (2014, p. 130). This future-orientation involves considering the aspirations of the participants for their designated future as qualified teachers of mathematics. Sfard and Prusak (2005) define designated identity as 'presenting a state of affairs which, for one reason or another, is expected to be the case, if not now, then in the future' (p. 18).

1.8 Contribution of the research

Whilst there is wide-ranging literature on the professional identities of teachers (Beauchamp and Thomas, 2009; Beijaard, Meijer and Verloop, 2004), and an increasing body of literature on the identities of those who are changing career to enter the teaching profession (Grier and Johnston, 2009, 2012; Williams, 2010; Wilson and Deaney, 2010), there is little reference in the literature to the identities of those who enter teaching via a subject enhancement course route.

Government-commissioned evaluations of subject enhancement courses have noted the positive contribution that these courses have made to 'directly raise the number of candidates eligible to train to teach priority subjects' (TDA, 2007, p. 9) by

‘providing an alternative route into teaching… and supporting the supply and quality of teachers into the profession’ (Gibson et al., 2013, p. 16).

The literature on mathematics subject enhancement courses has focused on evaluating the success of these courses (May et al., 2008; Stevenson, 2008) and, in particular, the nature of mathematical subject knowledge for teaching (Adler et al., 2014; Edwards et al., 2015; Hossain, Mendick and Adler, 2013; Stevenson 2013; Warburton 2015). These studies support the findings of government-commissioned evaluations (TDA 2007; Gibson et al., 2013) that subject enhancement courses are a successful strategy for widening the pool of potential mathematics teachers.

Whilst there is acknowledgement in the literature of the changing profile of those entering mathematics ITT (May et al., 2008), in particular the level of mathematics qualifications and the presence of alternative subject specialisms, there has been little reference to the identities of subject enhancement course participants. It is suggested that learning more about ‘the various identities’ that subject enhancement course participants ‘come in with’ and how these influence professional identities should be the focus of future research (Hossain, Mendick and Adler, 2013, p. 46). This study sets out to contribute to addressing this gap.

1.9 Organisation of the thesis

This thesis comprises six chapters. The present chapter has discussed the aims, context and justification for the research. The second chapter provides a review of the literature on identity, in particular the professional identities of teachers and the implications of incoming identities for participants in initial teacher education. This is followed by Chapter 3, providing an overview of the research design and methodology, which is underpinned by my positioning as a researcher, which in turn

has influenced the nature of the research. Chapter 4 presents the data in the form of participant stories of their lived experiences. Chapter 5 provides an interpretation of the key findings arising from the participant stories, using a framework for analysis developed from Wenger's (1998) notion of trajectories. Finally, Chapter 6 concludes the study by responding to the research questions, considering the contribution to research and the implications for practice and future research.

Chapter 2: Literature Review

2.1 Introduction to the chapter

The purpose of this chapter is to explore the literature, and to identify any gaps in the literature, relating to the research questions set out in the introduction (section 1.7). The aim of this study was to explore how being a graduate of a non-mathematical discipline might influence the negotiation of identities as a teacher of mathematics. The focus is on those who follow a subject enhancement course as an alternative route to initial teacher education.

The literature relating to subject enhancement courses is reviewed, in particular the background, aims and evaluation of these courses (section 2.8). The review of literature in this area identifies a gap in the literature on the identities of subject enhancement course participants. The absence of a term to refer to subject enhancement course participants, as non-traditional participants in initial teacher training, lead to the introduction of the term 'subject switcher' (section 1.6).

First, the literature relating to identity is considered broadly, and then specifically in the context of mathematics education and teacher education. Consideration is given to the social and professional aspects of identity, in the context of initial teacher training.

2.2 Identity in general and in the context of mathematics education

The concept of identity has been explored in the fields of philosophy (Mead, 1934; Taylor, 1989), psychology (Erikson, 1968), and anthropology (Holland et al., 1998). Hence, notions of identity range across approaches from these different disciplines

as well as within the literature. Gleason (1983, p. 914) referred to Erikson as 'the key figure' in introducing the popular use of the word *identity* with the terms 'mid-life crisis' and 'identity crisis': however, DaSilver (2011) refers to Mead as the 'father' of identity.

Identity has broadly been considered to be 'an acquisition' (Erikson, 1968) or 'an action' (Mead, 1913). From an Eriksonian perspective, identity is something that one has inside of oneself (that is asserted through action) that becomes coherent and consistent, whereas a sociological, Meadian perspective sees identity as something that one does, a process that is multiple, contradictory and socially constructed. To describe self, Mead artificially split 'I' and 'me' to illustrate the way in which the self becomes 'other to itself' due to conflicts and new identity is constructed. Mead refers to this as 'a new self arises' whilst acknowledging the 'different voices in conflict with each other' and the 'dominant part of the old self' (1913, p. 378). In the context of this study, teacher identity is negotiated during participation in initial teacher education, although aspects of this may be in conflict with existing identities from current or prior social or professional roles.

Many of the key theorists, drawn on by researchers into mathematics education, fit their definition of identity within a Meadian frame (Mead, 1913) where identity is viewed to be an action, rather than an acquisition (Boaler and Greeno, 2000; Gee, 2000; Holland et al., 1998; Sfard and Prusak, 2005; Wenger, 1998). Although some researchers in mathematics education offered no definition of identity and, where definitions were offered, the work was sometimes theoretically incompatible with the given definition (Darragh, 2016), where definitions of identity were offered, the most popular definitions were from outside of mathematics education (Wenger, 1998; Lave and Wenger, 1991; Holland et al., 1998; Gee, 2000). Wenger (1998) defines

identity as a ‘learning process’ (p. 163) and a ‘constant becoming’ (p. 154) whilst Holland et al. (1998, p.3) describe an ‘identity-making process’ and Gee (2000, p.99) refers to identity as being recognised as ‘a kind of person’ within a particular context.

Within mathematics education, ‘identity work’ is a popular term, indicating that identity is something that we do (Hossain, Mendick and Adler, 2013). Other popular definitions of identity, from within the field of mathematics education, include Boaler and Greeno (2000), Sfard and Prusak (2005) and Martin (2000, 2012). Boaler (2002) considers identity to involve a relationship with knowledge construction and Sfard and Prusak (2005) equate identity with the telling of stories. Whilst Martin (2012) defines identity as a set of beliefs (something we have inside of us) that can be asserted by action, he also considers using mathematics to change one’s life (a process), hence bridging the divide between identity as an acquisition and identity as an action. In all of these cases, identity is considered to involve some form of action, rather than pure acquisition. This is the perspective that is assumed throughout this study.

Whilst not all research on identity in mathematics education makes clear the theoretical framework, this is a feature of those who followed the definitions of Wenger (1998), Boaler and Greeno (2000) and Martin (2000).

The work of Wenger (1998; 2000) has been drawn on to research pre-service and novice teachers’ experiences of becoming a teacher (Friedrichsen et al., 2008; Goos and Bennison, 2008; Solomon et al., 2017) and in-service experiences of teacher professional development within communities of practice (Graven, 2003; 2004). A ‘community of practice’ is defined by Lave and Wenger (1991) as ‘a set of relations

among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice' (p.98).

Wenger's communities of practice framework (1998) has been used more recently by Solomon et al. (2017) in their research into the difficulties experienced by some beginning teachers in Norway in taking up the role of 'legitimate peripheral participant' (Lave and Wenger, 1991) during school placements. Solomon et al. take a communities of practice perspective to explore the 'idea of movement across intersecting and sometimes conflicting communities of practice' whilst undertaking initial teacher education (2017, p. 141).

Friedrichsen et al. (2008) used Wenger's (1998) social theory of learning as a tool for examining teacher learning (p. 176) and viewed 'the process of becoming a teacher as a learning trajectory' (Wenger, 1998). Friedrichsen et al. found Wenger's trajectories provided a 'new perspective' for understanding the identities of their participants (2008, p. 183).

2.3 Wenger's social theory of learning and trajectories

Wenger (1998) defines identity as 'a way of talking about how learning changes who we are and creates personal histories of becoming in the context of our communities' (p. 5). The social theory of learning proposed by Wenger (1998) has been a useful lens for considering teacher learning in mathematics (Friedrichsen, 2008; Goos and Bennison, 2008; Graven, 2004; Solomon et al., 2017).

Wenger's social theory of learning comprises four components: learning as experience (meaning), learning as doing (practice), learning as belonging (community), and learning as becoming (identity). These components 'characterise

social participation as a process of learning and of knowing' (Wenger, 1998, p. 5).

These four components are described in Table 1.

Table 1: Wenger's components of learning

Component of learning	Description of component of learning (Wenger, 1998, p. 5)
Meaning: learning as experience	A way of talking about our changing ability to experience our life and the world as meaningful.
Practice: learning as doing	A way of talking about the shared historical and social resources, frameworks and perspectives that can sustain mutual engagement in action.
Community: learning as belonging	A way of talking about the social configurations in which our enterprises are defined as worth pursuing and our participation is recognised as competence.
Identity: learning as becoming	A way of talking about how learning changes who we are and creates personal histories of becoming in the context of our communities.

Wenger (2000, pp. 227-228) identifies three modes of belonging that describe the 'different forms of participation' in social learning systems: engagement, imagination and alignment. These modes of belonging are described in Table 2.

Table 2: Wenger's modes of belonging

Mode of belonging	Description of component of mode of belonging (Wenger, 2000, pp. 227-228)
Engagement	The ways in which we engage with each other and the world profoundly shape our experience of who we are. We learn what we can do and how the world responds to our actions.
Imagination	Constructing an image of ourselves, of our communities, and of the world, in order to orient ourselves, to reflect on our situation and explore possibilities.
Alignment	Ensuring that our activities are sufficiently aligned with other processes so that they can be effective beyond our own engagement. This is not a one-way process but a mutual process of coordinating perspectives, interpretations, and actions.

According to Wenger, identity is a learning process, a ‘constant becoming’ and ‘something we constantly renegotiate during the course of our lives’ (Wenger, 1998, p. 154). Individuals take multiple paths that lead to the formation of new identities, Wenger refers to these paths as ‘trajectories’ and describes identity as ‘a trajectory in progress that includes where you have been and where you are going, your history and your aspirations’ bringing ‘the past and future into the experience of the present’ (2000, p. 241). Wenger (1998) identifies five types of trajectories: peripheral, inbound, insider, boundary; and outbound. Table 3 provides an overview of Wenger’s trajectories.

Table 3: Wenger's five trajectories

Type of trajectory	Description of Trajectory (Wenger, 1998, pp. 154-155)
Peripheral	Peripheral trajectories provide access to a community and its practice that may contribute to one’s identity, though not necessarily leading to full participation.
Inbound	Newcomers joining a community with the potential of becoming full participants in its practice in the future; present participation may be peripheral.
Insider	Identity continues to evolve in response to continued experiences as full members of a community.
Boundary	Boundary trajectories link communities of practice, sustaining identities across communities.
Outbound	Outbound trajectories lead out of a community and involve seeing the world and oneself in new ways.

These trajectories lead into and out of communities of practice. Individuals may belong to multiple communities and it is how they reconcile these multiple memberships that leads to developing identities. This process is ongoing as individuals move across boundaries from one community to another.

Wenger states that the term trajectory does not suggest ‘a path that can be foreseen or charted but a continuous motion – one that has a momentum of its own in addition

to a field of influences. It has a coherence through time that connects the past, the present, and the future' (p.154) and 'incorporates both past and future into the meaning of the present' (p. 163). Wenger (1998) refers to the 'nexus of multimembership' where 'multiple trajectories become part of each other, whether they clash or reinforce each other' (p. 159) hence constructing new identities as different forms of membership are reconciled.

2.4 Narrative identity

Narrative identity is defined as identity equating with stories (Sfard and Prusak, 2005), hence making use of the stories that people tell. Kaasila (2007) uses the notion of 'mathematical biography' to understand teacher identities in mathematics, drawing on Clandinin and Connelly's (2000) *Narrative Inquiry*. Much mathematics education research (Heyd-Metzuyanim, 2013; Heyd-Metzuyanim and Sfard, 2012; Andersson, 2011; Bishop, 2012; McCulloch et al., 2013) has drawn on Sfard and Prusak's (2005) definition of identity as the stories that people tell about themselves that are 'reifying, endorsable and significant' (p. 16). Sfard and Prusak identify two types of identities: actual identity and designated identity. Actual identities consist of 'stories about the actual state of affairs' in the present tense whilst designated identities consist of narratives presenting a state of affairs that are 'expected to be the case, if not now then in the future' (2005, p. 18).

> Designated identities are stories believed to have the potential to become part of one's actual identity. They can be recognised by their use of the future tense or of words that express wish, commitment, obligation or necessity. (Sfard and Prusak, 2005, p. 18)

Sfard and Prusak define identity as ‘closing the gap between actual and designated identity’ (2005, p.19) and refer to identity as the ‘missing link’ between learning and its sociocultural context (p. 19).

2.5 Personal identities and social identities

Desrochers, Andreassi and Thompson (2004) suggest that identity is the answer to the question ‘who am I?’ (p. 2). If identity is a ‘sense of self’ and the answer to the question ‘who am I?’, then personal identity can be thought of as the answer to the question, ‘who am I as an individual?’ In other words, what distinguishes me from others in society? Who I am as an individual is a ‘sense of self’ that an individual develops throughout life which is not static, but ever changing. Teixeira and Gomes (2000) align personal identity with self-concept, stating that it ‘expresses the set of perceptions that a person has about the relationship between self, others and world’ (p.80).

Whilst Gee (2000, p.99) suggests that one might have a core identity and multiple forms of this identity operating in different contexts. Jones and McEwen (2000) argue that central to a person’s sense of identity is the ‘core’ or ‘inner self’, which includes personal attributes, character and values. Surrounding this core are contextual influences on personal identity such as family background, gender, sociocultural conditions, current experiences, career decisions, and life planning. Whilst each identity constitutes a particular dimension of a person’s life, they do not exist independently of each other and ‘no one dimension may be understood singularly; it can be understood only in relation to other dimensions’ (p. 410).

Social identity, however, requires a collective approach and is created as an individual interacts with others and identifies self as part of society. Social identity is

our understanding of who we are, and who others are, in our social contexts. Our perception of identity is 'influenced by what we think others think of us, as we enact our various roles' (Desrochers, Andreassi and Thompson, 2004, p. 2). Darragh (2016) refers to social identity as common categories of identity 'such as gender, race/ethnicity and class/socioeconomic status' (p. 23).

Whilst Ibarra (1999, p. 766) states that identity is 'constructed and negotiated in social interaction', other research (Law, Meijers and Wijers, 2002; Olesen, 2001) suggests that the development of a personal identity involves individual as well as social learning and that this cannot be separated from past and present social contexts. The importance of life histories and reflexivity in the construction of personal identities is emphasised by Law, Meijers and Wijers (2002) whilst Olesen (2001, p. 18) acknowledges this as a 'contradictory and dynamic subjective process'.

Darragh (2016) identified a number of articles in mathematics education that related to common categorisations of social identity 'such as gender, race/ethnicity, class/socio-economic status' as well as other groups such as 'English language learners, immigrants, low achievers, or the generic "underserved" members of society' (p. 23). Many of these studies were concerned with equity issues and investigated the ways in which these groups of students merge their social identities with their mathematical identities. Darragh suggests that identity research can be a vehicle to 'investigate students' experiences of marginalisation' (2016, p.23). The roles and responsibilities that an individual has in society are also important when understanding social identity, for example, family or community roles.

2.6 Teachers' professional identities

If social identity is understood to be who we are in a social context, then professional identity can be understood to be who we are in a professional context. Professional identity can be considered to be one component of multiple perspectives of a persons' identity, the component that is associated with their professional status as a teacher.

Over the last thirty years, the formation of teachers' professional identity has emerged as a research area in its own right. Beijaard, Meijer and Verloop (2004, p.109), in their review of research on teachers' professional identity published between 1988 and 2000, reported that the research could be divided into three categories of study in which the focus was on:

1. teachers' professional identity formation (Antonek, McCormick and Donato, 1997; Volkmann and Anderson, 1998)
2. the identification of characteristics of teachers' professional identity (Beijaard, 1995; Beijaard, Verloop and Vermunt, 2000)
3. professional identity represented by teachers' stories. (Connelly and Clandinin, 1999).

Beauchamp and Thomas (2009, p. 175) in their later overview of the literature on teacher identity claim that the literature provides arguments for the importance of identity for different reasons:

> It can be used as a frame or analytical lens through which to examine aspects of teaching: the ways in which students integrate a range of influences, the necessary confronting of tensions and contradictions in their careers (Olsen, 2008). It can be seen as an organising element in teachers' professional lives, even a 'resource that people use to explain, justify and make sense of themselves in relation to others, and to the world at large'. (MacLure, 1993, p.311)

Whilst the literature on teacher education identifies the importance of identity in teacher development, Beauchamp and Thomas (2009) recognise that understanding identity can be a 'challenging endeavour' (p.175). One of the greatest challenges in gaining an understanding of identity seems to be resolving a definition of it

> One must struggle to comprehend the close connection between identity and the self, the role of emotion in shaping identity, the power of stories and discourse in understanding identity, the role of reflection in shaping identity, the link between identity and agency, the contextual factors that promote or hinder the construction of identity, and ultimately the responsibility of teacher education programs to create opportunities for the exploration of new and developing teacher identities. (p. 176)

The absence of a definition of identity in research on teacher professional identity had been previously identified by Beijaard, Meijer and Verloop (2004) who found that the concept of teacher professional identity 'was defined differently or not defined at all' in the 25 relevant studies on the subject published between 1988 and 2000 (p. 125). Despite the absence of a definition in several of the studies, they identified four features of professional identity:

1. it is an on-going, constantly evolving process and hence is dynamic rather than stable;
2. it involves a context as well as a person;
3. there are sub-identities that need to be balanced;
4. it involves agency, in accordance with teacher standards. (Beijaard, Meijer and Verloop, 2004, p. 22)

Beauchamp and Thomas (2009) also found that the literature on teaching shares a common notion that 'identity is dynamic, and that a teacher's identity shifts over time under the influence of a range of factors both internal to the individual, such as emotion… and external to the individual, such as job and life experiences in particular context' (p. 177). The potential influence of these 'incoming' external factors, on transitioning teacher identities, is explored in the next section.

2.7 The incoming identities of beginning teachers

Beginning teachers have wide-ranging personal and professional experience and multiple identities. These existing, or prior, identities are referred to as 'incoming identities' (Friedrichsen et al., 2008). This section is split into the following sub-sections: teacher identities, career identities, and subject identities.

2.7.1 Teacher identities

Lortie (1975) identified that all beginning teachers have experience of teaching through an 'apprenticeship of observation' (p. 61) that they acquired through their own schooling. Beginning teachers commence their initial teacher education having spent many hours as pupils in school, observing and evaluating teachers in action. Lortie argues that this apprenticeship is different from that of other professions, such as doctors and lawyers, and suggests that this accounts for many of the preconceptions that beginning teachers have about teaching. Lortie explained that a student 'sees the teacher frontstage and centre like an audience viewing a play' and that students see the 'frontstage' behaviours, of teaching and marking, they do not see the 'backstage' behaviours which are central to a teacher's performance:

> Students do not receive invitations to watch the teacher's performance from the wings; they are not privy to the teacher's private intentions and personal reflections on classroom events. Students rarely participate in selecting goals, making preparations, or post-mortem analyses. Thus they are not pressed to place the teacher's actions in a pedagogically oriented framework. (Lortie, 1975, p. 62)

Friedrichsen et al. (2008) examined the incoming identities of beginning mathematics and science teachers on an Alternative Certification Programme (ACP) in the United States, using identity as a theoretical lens. They found three general variations of incoming teacher identities: always a teacher, late decider, and career explorer (p.

177). Those in the ‘always a teacher’ category had existing teacher identities and some experience of teaching. This group had wanted to be teachers from an early age and had ‘encountered obstacles’ preventing them from qualifying as a teacher previously. The ‘late decider’ group ‘held emerging teacher identities’ and had decided more recently to become teachers. Those in the ‘late decider’ group fell into two categories: ‘recent graduates and second-career individuals’ (p. 178). The recent graduates had decided late in their undergraduate course to become teachers and the second-career individuals had decided later in life to become teachers, after having alternative careers. Finally, those in the ‘career explorer’ group did not hold a professional identity and were unsure of their career paths. Those in the ‘career explorer’ group included those with ‘many career choices who considered teaching among their many options’ and ‘those who appeared to have few career choices and fell back on teaching’ (p. 179).

In addition, Friedrichsen et al. (2008) found that participants held multiple non-teaching identities, including parent, student, professional, tutor, coach, and college instructor. Some of these incoming identities supported their teacher identity (e.g. tutor or parent) whilst other identities (e.g. college instructor) caused tension (2008, p. 185). The incoming identity of tutor ‘provided a window into the world of teaching’ allowing participants to ‘experience the joys of teaching and to see it as a potential career’ (p. 181). Tutoring allowed the participants to ‘view themselves as teachers’ by supporting the participants to ‘recognise characteristics of teachers in themselves’ (p. 182). The incoming identity of parent appeared to provide support in the transition to teaching in particular ‘the connections that they made to children’s thinking’ (p. 180). On the other hand, the incoming identity of college instructor caused tensions, in particular regarding classroom management issues that

contrasted with their prior role. Friedrichsen et al.'s (2008) study found that career changers had experiences that supported their future roles as teachers as well as experiences that 'required adjustments in view of their new profession' (p. 181).

Friedrichsen and colleagues advised that it is important to consider the 'nexus of multimembership' (Wenger, 1998) of participants in the development of a teacher identity (Friedrichsen et al., 2008, p. 185). Similarly, Crisan and Rodd (2011) identified how a 'nexus of communities' was 'considered beneficial' for non-specialists teaching mathematics and that 'pedagogical approaches developed and acquired before starting to teach mathematics are 'brought' into the mathematics classroom' (p. 33).

The nexus of multimembership potentially becomes more complex where beginning teachers have significant alternative career and/or subject experience. These are explored in the proceeding sub-sections.

2.7.2 Career identities

The literature varies in the defining of a 'career changer'. The definition that will be used for this study is that used by Williams and Forgasz (2009).

> A student who has worked for at least three years in a career other than teaching, including full or part time, paid or unpaid work, and/or parenting, prior to enrolling in their current teacher education course. (Williams and Forgasz, 2009, p. 97)

This definition has been chosen as the time stated, three years, ensures that the individual has had time to develop competencies in their previous career and the definition explicitly includes those who have experience of voluntary roles or parenting, unlike other available definitions.

Williams (2010) identified that there was limited research into the identities of those who enter teaching as a 'career changer'. Research available in this area has mainly focused on the motivations for making a career change to teaching (Anthony and Ord, 2008; Priyadharshini and Robinson-Pant, 2003; Richardson and Watt, 2005, 2006; Williams and Forgasz, 2009). Mayotte (2003) however considered how 'previously developed career competencies' influenced the 'career switchers' transition to teaching. Mayotte suggests that supporting career switchers to see the connections of their learning and development through a previous career to everyday classroom activity can support their transition to teaching. Finding out more about the role of previous career experience in negotiating new professional identities may help us to better understand the training needs of the increasing number of career changers who have reportedly been moving into teaching (Walker and Williams, 2010).

Williams identified that whilst 'there is much literature about the construction of a teacher identity in relation to pre-service and in-service teachers' there is 'less research into the complexity of this process for those who enter teaching education having had one or more previous career 'identities' (2010, p. 1). Like Friedrichsen et al. (2008), Williams suggests that career change students have a 'diversity of identities' at any one time associated with work, status, gender, age, ethnicity and family and community roles and that several of these identities together create a career identity (Williams, 2010, p. 26).

Teixeira and Gomes' (2000) study of career change professionals also identified the influence of both professional and personal identities when considering individual career change trajectories. It is their view that career change must be considered 'in conjunction with the individual history and the interactions between the various life

roles that the subject performs' (p. 80) and social or economic factors (p. 92). Although Teixeira and Gomes claim that career change can be a 'recovery of part of the self lost or abandoned along the trajectory of career choices', they also acknowledge that career change can be a construction of 'new ways of being' or a more authentic self (p. 92).

In the United States, Grier and Johnston (2009; 2012) studied science, technology, engineering and mathematics (STEM) professionals entering teaching as career changers, and the 'complexity' of their 'transitioning identities' (Grier and Johnston, 2012, p. 19). Like Mayotte (2003), Grier and Johnston (2009) found that career changers 'relied upon skills developed in their previous careers to navigate through a new profession' (p. 57) and 'brought remnants of their STEM identity' to their teacher credential programme and to their teacher identity (p. 73). They also found that the career changers 'valued interacting with their traditional aged peers' and that these relationships were of benefit to their 'socialization into teaching as they developed their teacher identities' (p. 57).

In their later study, Grier and Johnston (2012), applied Wenger's (1998) five trajectories (Table 3) to conceptualise the career-changers' pathway to teaching (Figure 1).

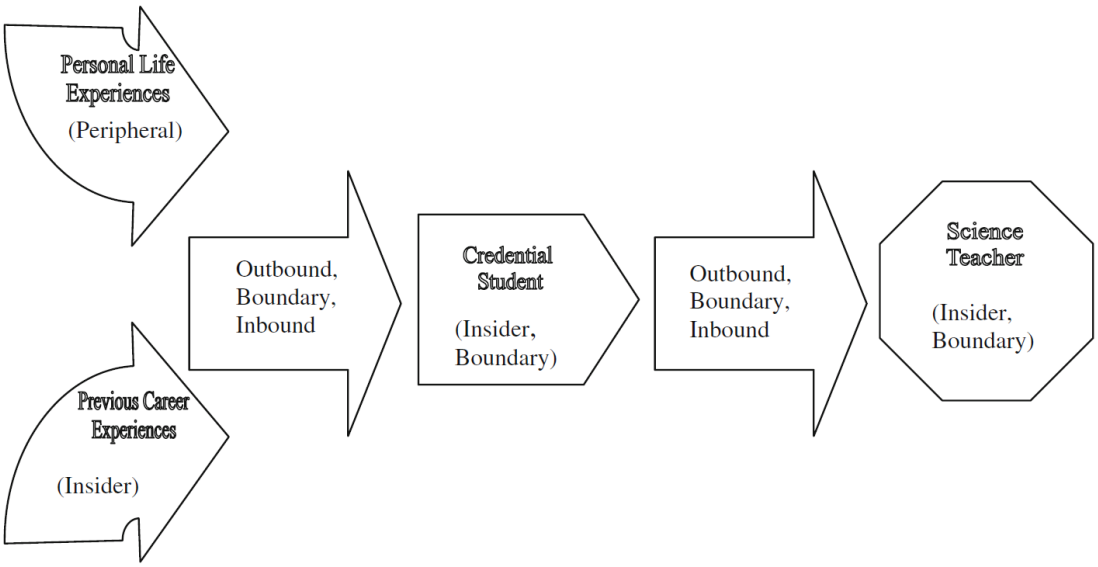

Figure 1: Grier and Johnston's conceptualisation of Wenger's trajectories and the career changers' pathway to teaching (2012, p. 23)

Grier and Johnston (2012) found that the 'transitioning career changers' in their study displayed all five of Wenger's trajectories with respect to entering the teacher credential programme community of practice (2012, p. 38). The career changers' lives reflected a 'complexity of identities' as they 'negotiate the many relationships and new knowledge while entering a community of practice' (p. 42). They found that the career changers 'relied upon their identities from their previous careers' when entering teaching but need support in terms of 'returning to be a student again' and in the 'transition to their newly chosen career of teaching' (p. 19). Hence, Grier and Johnston (2012) claim that it is 'important to understand how career changers negotiate their past and potential futures' in the process of becoming teachers (p.23).

2.7.3 Subject identities

Whilst there is literature available on the formation of professional identities as a teacher of particular subject (Brooks, 2016; Brown and McNamara, 2011; Lutovac and Kaasila, 2014; Wilson and Deaney, 2010), there is been a dearth of literature on

the identities of those who train to teach a subject not directly related to the subject specialism of their undergraduate degree.

The introduction of subject enhancement courses has widened participation in initial teacher training, to graduates of non-related subject disciplines, resulting in an emerging field of research into this area over the last decade. The literature concerning subject enhancement courses is reviewed in the following section.

2.8 Subject enhancement courses

This section explores the emerging body of literature on subject enhancement courses, identifying key findings, limitations and gaps in the research in this area. This section is split into sub-sections exploring first the background and evaluation of subject enhancement courses, and then the findings of research in this area.

2.8.1 Background to subject enhancement courses

The Cockcroft Report (Cockcroft, 1982), *Mathematics Counts,* identified concerns regarding the recruitment and retention of secondary school mathematics teachers, the quality of mathematics teaching in schools and the subject knowledge of beginning teachers. More than two decades later, in response to concerns over the shortage of mathematics teachers in England, the Teacher Training Agency (TTA) introduced subject enhancement courses as a strategy to address some of these issues. Government-funded pre-ITT mathematics enhancement courses (MECs), later to be relaunched by the Training and Development Agency for Schools (TDA) as subject knowledge enhancement (SKE) courses, were piloted at two higher education institutions during 2003-2005 (DfES, 2002; McNulty, 2004). The mathematics enhancement course supported graduates without the required

mathematics subject knowledge and understanding to train to become teachers of mathematics. The specification for the pilot pre-ITT enhancement courses was heavily influenced by the work of Ma (1999) and based on the philosophy of the development of a 'profound understanding of fundamental mathematics', emphasising deep understanding of concepts, as against surface procedural knowledge (Ma, 1999). Government-commissioned evaluations of the pilot courses noted the value of these courses as specially designed for a target group and reported improvements in subject knowledge, attitude, understanding and confidence in participants in readiness for initial teacher education (Seabourne, 2004).

The Smith Report (Smith, 2004), *Making Mathematics Count*, into post-14 mathematics education, supported the expansion of government initiatives to increase the numbers of mathematics teachers whilst acknowledging concerns that 'enhancement courses will necessarily be attracting potential entrants to the teaching profession with varying levels of mathematical knowledge' (p. 6). Following Smith's recommendations, the subject enhancement course pilot was rolled-out across England to support the recruitment of 'prospective trainee teachers of mathematics who do not have a mathematics degree' (DfES, 2004, p. 24). Further evaluations of the pilot courses recommended a greater emphasis on developing a deep understanding of mathematics (TDA, 2007). By 2007, there were twenty mathematics enhancement courses in operation nationally (TDA, 2007) and whilst this led to distinctive models being developed for individual programmes, these remained firmly rooted in the philosophy and principles set out in the original TTA specification with the objective of 'deep understanding' (TTA, 2003, p. 2).

2.8.2 Evaluation of subject enhancement courses

Over a decade after the introduction of subject enhancement courses, which by then had been relaunched by the erstwhile Training and Development Agency (TDA) as subject knowledge enhancement (SKE) courses offered in a range of shortage subjects and of variable length, Warburton (2015, p. 8) calculated that 'over a third' of mathematics PGCE students had taken a SKE course prior to commencing their initial teacher education in 2010-2011. Despite the significant contribution of subject enhancement courses to the numbers engaging in mathematics initial teacher education, Warburton reported that there had been 'a dearth of literature into the effectiveness and implications of this policy' (2015, p. 56).

Gibson et al.'s (2013) government-commissioned evaluation was concerned with the effectiveness of SKE courses across subjects, not just in mathematics. This evaluation concluded that:

> There is clear evidence that these courses are successful in preparing trainees with the subject knowledge they require, equipping them to specialise in teaching a subject in schools, providing an alternative route into teaching which is on a par with traditional entry teacher training and supporting the supply and quality of teachers into the profession. (Gibson et al., 2013, p. 16)

Despite this conclusion, Gibson and colleagues noted that, whilst subject knowledge enhancement courses 'provide trainees with a high level of subject knowledge and confidence… and preparation for their PGCE training' (p. 11), the students considered their subject knowledge to be at a lower level than traditional route teacher trainees who were subject graduates. Whilst subject enhancement course participants perceived that subject graduates had 'higher levels of knowledge' which would help them teach at higher levels, they also felt that 'the knowledge that subject

graduates might have could be less relevant to the school context' (p. 11). The perception of the subject enhancement course participants was that they would be 'better equipped… to break down the subject for students, and to understand misconceptions and the difficulties pupils faced', having experience of the SKE course (p. 13).

Gibson and colleagues' evaluation also found that many newly qualified teachers who had completed a subject enhancement course came to regard themselves as 'subject specialists', with the majority of these considering that their colleagues would also view them as such. A subject specialist was broadly considered to have both the 'subject knowledge and ability to teach the subject', hence 'specialist subject knowledge for teaching their subject' (p. 13). A subject specialist was sometimes referred to as 'having greater depth and breadth of subject knowledge – recognised as graduate level understanding' (p. 13).

Gibson et al.'s (2013) found that many participants in their evaluation were career changers and the SKE gave them the opportunity to realise a career in teaching. For many career changers, it had been a substantial amount of time since they had been in education. Gibson and colleagues found that career aspirations whilst on the SKE, PGCE and as a Newly Qualified Teacher (NQT) were similar but that those in mathematics were 'more likely to aim to specialise in teaching one subject with about a quarter aiming to become a head of department' (p. 15).

Gibson et al.'s (2013) evaluation of SKE courses has been criticised by researchers in this area (Hossain et al., 2014; Warburton, 2015) as the data were limited to students' perceptions of their subject knowledge rather than derived from an evaluation of outcomes (Warburton, 2015) and outcomes of employability, retention

and progression were not evaluated (Hossain et al., 2014). Hossain et al. (2014) argue that evaluation of 'fit for purpose must go beyond entry to include retention and progression' (p. 177).

Some small-scale studies by initial teacher education practitioners into individual enhancement courses (Clarke, 2009, 2011; May et al., 2008; Stevenson, 2008, 2013) and some larger studies across a number of enhancement courses (Adler et al., 2009; Hossain et al., 2014; Warburton, 2014; 2015) illuminate their successes and limitations. These insights are discussed below.

May et al.'s (2008) evaluative case study of the collaborative subject enhancement course offered by three higher education institutions measured the success of the course against the original TTA objectives (TTA, 2003) and a developed success criteria concerning subject knowledge for teaching, improved skills for teaching, realisation of student expectations, and insights gained into teaching (p. 151). At this time, subject enhancement courses in mathematics were referred to nationally as mathematics enhancement courses (MEC). May et al. (2008) found that, although there was considerable variation in the backgrounds of the participants, in terms of maturity, post-16 education and experience of graduates, it was performance in mathematics A-level that was associated with outcomes on the MEC. Hence, suggesting that a good A-level in mathematics is a 'significant attribute' even though it may not be a requirement of the course (p. 152).

May and colleagues identified four themes emerging from their study: the value of the MEC, the bonding/group cohesiveness, expectations of the MEC versus actual experiences, and advantages of the MEC for PGCE students. May at al. (2008) found that the reported value of MEC was beyond enhancing the mathematical

subject knowledge and understanding of participants 'in terms of enabling students to experience a range of teaching methods and gain useful teaching resources' (May et al., 2008, p. 153). It was found that the MEC students felt 'much more prepared for the PGCE' due to the intensity of the MEC and their pedagogic learning, rather than personal learning, as a result of participating in the MEC (p. 155). They also reported that the 'group bonding and cohesiveness', perceived to be a 'direct result' of participation in the MEC, was 'less evident in the non-MEC PGCE students' (p. 154). Other advantages for those who had completed the MEC prior to starting PGCE were reported to be 'better developed study skills and maths knowledge, confidence, critical self-awareness and level of perceived preparation', compared with those who had not completed the MEC (p. 155).

May et al. (2008) suggest that the mathematics enhancement course is successful in supporting the government's aim to build an 'effective teacher workforce' in England that 'better reflects the diversity' of the pupil population and meets the success criteria for the programme of equipping participants with the subject knowledge required for initial teacher education (p. 155). May and colleagues highlight the importance of the mathematics enhancement course as a 'stepping stone to teacher training', through supplying the necessary mathematics knowledge (p. 155). In fact, data indicated that the mathematics enhancement course students had greater 'pedagogic knowledge' of mathematics than other trainee teachers (p. 157).

Clarke's (2011) mixed-methods study of participants on an individual mathematics enhancement course (MEC), highlighted insights into the relationship between trainee teachers' prior experiences as learners, their current experiences in the transition phase from learner to teacher and their future beliefs about their pedagogy as a teacher.

> There are complex relationships between how students understand mathematics as a subject, their own experiences of learning the subject at school and in higher education, their constructions of what kind of mathematics teacher they wish to be and their experiences of mathematics learning on the MEC. (Clarke, 2011, p. 7)

Clarke's study of mathematics enhancement course students identified three main themes: subject knowledge issues, transition from learner of mathematics to teacher of mathematics, and issues based on participants' own experiences as a learner during their own secondary education. First, regarding subject knowledge issues, despite acknowledging that the mathematics enhancement course had helped to 'build their mathematical confidence', unlike in Gibson et al.'s (2013) evaluation, participants acknowledged that they 'did not see themselves as mathematics experts' and still lacked confidence in their mathematical abilities (p. 5). Second, regarding the transition from a learner of mathematics to a teacher of mathematics, participants expressed that 'their relationship with the mathematical subject matter had changed' (p. 6). Finally, all participants stated that they were initially 'planning to teach as they had been taught at school' (p. 6).

Clarke draws on the work of Lortie (1975) in describing an overview of his three themes as the 'apprenticeship of observation' that students' experience 'having spent thousands of hours as schoolchildren observing and evaluating teachers in action' (2011, p. 6). However Clarke found evidence that participation in a mathematics enhancement course changed the beliefs of participants concerning the way in which they think mathematics should be taught from didactic to less didactic methods. He attributes this change in beliefs to exposure to a wide variety of teaching pedagogies on the mathematics enhancement course, which participants may not have previously experienced as learners.

Clarke (2011) acknowledges the limitations of his study imposed by the small participation group of four, and the possibility that his students may have been giving him the 'answers they felt I wanted' (p. 7). Clarke also cautions that these changes in beliefs may not actually be a function of the mathematics enhancement course and that students may not turn their newly formed beliefs into action in the classroom. The latter caution is supported by Clarke's earlier work, where it was found that beliefs were not necessarily realised in action (Clarke, 2009). Despite these limitations, Clarke (2011) believes that changing the beliefs of mathematics teachers will impact on the quality of mathematics teaching in the classroom.

Stevenson's (2008) study of an individual mathematics enhancement course (MEC) compared the grades of PGCE students who had been through an enhancement course against the general cohort and found no statistical significance between the PGCE grades of MEC and non-MEC participants, thus indicating that mathematics enhancement course students were almost as well prepared for PGCE as their peers from more traditional mathematical backgrounds. Similarly, Warburton (2014), in a larger study of over 141 PGCE students from 18 different institutions, found that subject knowledge enhancement (SKE) and traditional entry PGCE students have similar levels of mathematical knowledge for teaching both at the beginning and the end of a PGCE course (p. 348). Warburton (2013) notes of the limitations of her study that 'the non-SKE group contained some PGCE students who did not have a mathematics degree' and 'the SKE group contained some students who did have a mathematics degree' (p. 308). In addition, the varying lengths of SKE courses were not accounted for, nor were differences between courses across institutions.

Not acknowledging the length of the SKE course taken by participants is a serious limitation of the work of Warburton (2013) and the Department for Education (DfE)

evaluation (Gibson et al., 2013), as SKE courses have varied between two and 36 weeks in length, unlike the original six month MEC courses evaluated in the studies of Adler et al., (2009), May et al., (2008), Clarke (2009, 2011), and Stevenson (2008). Subject enhancement courses of different lengths cater for differing incoming subject knowledge needs. Someone who needs an eight-week (short) SKE is very unlikely to have the same level of subject knowledge gaps as someone needing a 28-week (long) SKE. In acknowledging the length of SKE, in terms of short or long, the findings of Warburton (2013) and Gibson et al. (2013) would gain increased viability.

Hossain et al.'s (2014) study into mathematics enhancement course participants across three institutions provides insight on elements that were not covered by the DfE (Gibson et al., 2013) evaluation in terms of: ease of entry to the profession, retention and progression (Hossain et al., 2014, p. 178). Hossain et al. found that the majority of MEC students progressed into teaching with most reporting that they secured their post easily. In line with the findings of Gibson et al. (2013), Hossain and colleagues found that enhancement course students 'did not face barriers to entering the profession' and that 'progression had been relatively easy' with many participants holding positions of responsibility (Hossain et al., 2014, p. 182). Whilst Gibson et al. (2013) explored the career aspirations of participants, Hossain et al. (2014) found that 'these aspirations were realised in practice' (p. 182).

Despite the noted limitations, the findings of these studies (Gibson et al., 2013; Hossain et al., 2014; May et al., 2008; Clarke, 2011; Stevenson, 2008; Warburton, 2014, 2015) suggest that SKE is a successful strategy for widening the pool of potential mathematics teachers.

2.8.3 Subject knowledge for teaching

Warburton's (2014) study supports the findings of earlier studies (Tennant, 2006; Stevenson, 2008, 2013) that degree qualifications do not predict success on an initial teacher education course. These studies challenge perceptions that high achievement in mathematical qualifications equate to successful teaching outcomes, suggesting that the knowledge required to teach mathematics is different to mathematical knowledge per se.

The implementation of subject enhancement courses rooted in the notion of 'understanding mathematics in depth' has prompted exploration of interpretations of this term (Adler et al., 2009). Adler et al.'s study of students across three MEC courses found some participants believed that their enhancement course would give them a 'leg up' in the PGCE as they had revisited school mathematics and relearned it 'in depth' (2009, p. 6). A focus of more recent studies into mathematics enhancement courses, in line with other research into mathematics education over the last decade, has been on the nature of mathematics subject knowledge for teaching (Adler et al., 2014; Edwards et al., 2015; Hossain, Mendick and Adler, 2013; Stevenson, 2013; Warburton, 2013, 2014, 2015). These studies draw on the work of Shulman (1986) and his conception of three key aspects of professional knowledge for teaching: subject matter knowledge (SMK); pedagogic content knowledge; and curricular knowledge. Refining Shulman's ideas, researchers have defined mathematical knowledge for teaching (MKT) as the mathematical knowledge that teachers need to carry out their work as teachers of mathematics (Ball, Thames and Phelps, 2008, p. 395). MKT includes 'common content knowledge' (CCK) and 'specialised content knowledge' (SCK). Hence, the research literature suggests that

‘teachers need more than just knowledge of the subject matter they are to teach in order to be effective teachers’ (Warburton, 2014, p. 344).

Whist the majority of literature on subject enhancement courses in the last decade has focused on the nature of subject knowledge, a small number of studies provide insight into the identities of subject enhancement course participants (Barnes et al., 2013; Hossain, Mendick and Adler, 2013).

2.8.4 Identities of subject enhancement participants

Whilst there has been an emerging body of literature over the last decade into subject enhancement courses, only two of these studies attend to the identities of subject enhancement course participants. Of these, only one study focuses solely on pre-ITT subject enhancement courses (Hossain, Mendick and Adler, 2013) whilst the other study (Barnes et al., 2013) focuses on both a mathematics enhancement course (MEC) and a Mathematics Specialist Teacher (MaST) programme to enhance mathematics teaching in-service for qualified primary school teachers.

Barnes et al. (2013) found that the literature suggests that one way to understand participants’ responses to enhancement courses is in terms of their self-positioning within a social context. Barnes and colleagues found that enhancement course programmes provided ‘ways of affirming visions of teaching and reactions to previous experience’ and provide a language and conceptual tools, enabling participants to ‘navigate their way through conflicting discourses’ (Barnes et al., 2013, p. 49).

Hossain, Mendick and Adler (2013) state that it is important to recognise that enhancement course programmes are ‘opening up’ mathematics teaching ‘to a

greater diversity of people – with a range of qualifications and cultural backgrounds' (p. 46). Hossain, Mendick and Adler suggest that ITE providers need to consider the 'various identities that people come in with and how this shapes what is possible for them in the MEC' as well as giving 'attention to student-teachers' identity work during their courses and when they enter schools' (p. 46) to 'ensure that becoming a successful teacher is equally available to all' (p. 35).

Crisan and Rodd (2011; 2017) and Stevenson (2016) focus on the identities of qualified teacher participants of in-service mathematics professional development programmes for non-specialist secondary mathematics teachers, namely the Mathematics Development Programme for Teachers (MDPT). The MDPT was a government-funded, part-time, course for secondary school teachers who are qualified teachers of alternative subjects and hence are not considered to be subject specialists.

As with pre-ITT subject enhancement courses, the MDPT was introduced following recommendations of the Smith Report (2004), regarding addressing the supply of mathematics teachers. Smith (2004) recommended that significant opportunities for professional development should be made available to serving mathematics teachers, in particular those who are qualified in subjects other than mathematics and hence are considered to be non-specialists.

A qualified teacher who is teaching a subject other than the one they trained to teach may be referred to as teaching 'out-of-field' (Ingersoll, 1999; Hobbs, 2013) or referred to as 'a non-specialist teacher' (Crisan and Rodd, 2017).

> A non-specialist teacher of mathematics is a school teacher who qualified to teach in a subject other than mathematics yet teaches mathematics to students in secondary school. (Crisan and Rodd, 2017, p. 104)

Crisan and Rodd's use of the term 'non-specialist teacher of mathematics' draws on the terminology used in the government literature on the supply and demand of teachers (2017, p. 106). Crisan and Rodd (2017) conversely defined a 'specialist mathematics teacher' as 'a teacher with Qualified Teacher Status (QTS), who had a relevant post A-level qualification' (p. 122). DfE (2012) data indicated that nearly a third of those teaching secondary mathematics in England did not have a post A-level qualification in mathematics, indicating a significant proportion of non-specialist teachers of mathematics. The introduction of the MDPT formally acknowledged that much school mathematics at secondary level is taught by non-specialists.

The specification and title of these post-ITT subject enhancement courses have evolved and these courses are currently known as the Teacher Subject Specialism Training (TSST) course (National College for Teaching and Leadership (NCTL), 2016).

Crisan and Rodd's (2011) study of MDPT participants distinguishes between being a 'non-specialist teacher of mathematics' and a 'mathematics teacher'. Crisan and Rodd found that 'evolving mathematics teacher identities' arise from 'participation in a web of communities that relate to mathematics teaching' (2011, p. 32) and identified three ways in which participation in these courses, and multiple communities of practice, contributed to a mathematics teacher identity: learning new mathematics; developing a view on the nature of mathematics; and teaching mathematics in different ways. Although these finding are in line with research into pre-ITT subject enhancement courses, and particularly support Clarke's (2011) work on the changing beliefs about teaching mathematics, Crisan and Rodd reported 'a discrepancy between the teachers' espoused confidence in being a mathematics teacher and their technical mathematical competence' (2011, p. 29). However the

post-ITT SKE participants in Crisan and Rodd's study claimed that having experienced difficulties in learning mathematics themselves put them in a better position to relate to pupils than those teachers for whom mathematics came easily.

> In Wenger's terms, these teachers negotiate their contribution to the practice of mathematics teaching community. They are aware of their limitations and, instead of positioning themselves as outsiders (as they do not have a strong mathematical background), they focus their attention on the meanings that really matter to them: their struggle with mathematics gives them a special insight into understanding pupils' difficulties with mathematics and this privileged viewpoint offers them access to participating and contributing in the mathematics teaching profession. (Crisan and Rodd, 2011, p. 34)

It is argued that mathematics teacher education programmes, such as subject enhancement courses, are social practices (Adler et al., 2014; Crisan and Rodd, 2011; Hossain, Mendick and Adler, 2013) and that student teachers are participants in communities of practice (Lave and Wenger, 1991; Wenger, 1998). Graven (2004) also highlights the importance of engaging in a mathematics education community and, like Crisan and Rodd (2011), discusses teachers' learning on professional development programmes as induction into a community of practice (Wenger, 1998).

Stevenson (2016) argues that a 'growth in knowledge and confidence can alter one's perceived identity' having found changes to the MDPT participants' 'perceptions of their professional selves' as they began 'seeing themselves in a different way – as maths teachers' (p. 4), having previously had an identity as a teacher of another subject. Stevenson argues that this can be understood in terms of shift in identity which echoes the earlier findings of Crisan and Rodd (2011).

As with Clarke (2011) and Barnes et al. (2013), Stevenson (2016) found that novice mathematics teachers' strategies for teaching the subject are often based on their own experiences of being taught school mathematics, which were 'often very

procedural in approach' (Stevenson, 2016, p. 6). Stevenson (2016) found that 'reconstructing existing knowledge can result in transformation of teacher approach' (p. 5). Whilst this also echoes the findings of Clarke (2011), who found that enhancement course participants shifted in their beliefs of how mathematics should be taught, Clarke (2009) suggested that these changes in views on how mathematics should be taught are not always realised in the classroom.

In addition to Crisan and Rodd (2011, 2017) and Stevenson (2016), other studies outside of the UK have considered in-service programmes for non-specialist mathematics teachers (Graven, 2004; Vale, McAndrew and Krishnan, 2011). Vale, McAndrew and Krishnan's (2011) Australian study suggests that the length of the programme and the quality of relationships established are important for teachers' mathematical development. Graven's (2004) South African study also found that confidence develops over time and supports the work of Crisan and Rodd (2011) and Stevenson (2016) that illuminates the shift in teachers' perceived identities, from 'teacher of mathematics' to 'mathematics teacher'. Crisan and Rodd (2017) operationalised the notion of 'mathematics teacher identity' (p. 108), agreeing with Grootenboer and Zevenbergen (2008) that it is 'essential' for teachers of mathematics to 'have well-developed personal mathematics identities' (p. 248).

The research into subject enhancement courses has mostly focussed on either evaluating the success of these courses or on the nature of subject knowledge for teaching. Research into the identities of subject enhancement course participants is limited and it is suggested that learning more about the 'various identities that people come in with' and 'how this shapes what is possible for them' (Hossain, Mendick and Adler, 2013, p. 46) should be the focus of future research to inform the role of teacher educators in supporting this transition.

2.9 Subject switchers

Whilst this review identifies a dearth of literature on the professional identities of those who train to teach a subject not directly related to the subject of their degree (i.e. subject switchers, section 1.6), the literature relating to career changers entering teaching (section 2.7.2) is relevant and, in some cases, transferrable to the context of subject switchers entering teaching. For example, Mayotte's (2003) notion of 'previously developed career competencies', is transferrable to the context of previously developed subject competencies. Both career changers and subject switchers have a range of alternative experiences and identities that they bring with them to initial teacher education. Some prior experiences are more transferrable than others in becoming a teacher and equally some incoming identities are more supportive of negotiating an identity as a teacher of mathematics, whilst others may provide tension.

2.10 Conclusion to the chapter

This chapter has explored the literature relating to identity in the context of mathematics education, in particular the role of incoming identities such as social, career and subject identities in negotiating identities as a teacher of mathematics.

Research in this area suggests that incoming identities are of importance in negotiating professional identities as beginning teachers of mathematics (Hossain, Mendick and Adler, 2013). Of particular note is the role of a beginning teacher's own experience of learning mathematics, both during their school education and as a returner to learning mathematics (Clarke, 2011), i.e. their mathematical identity.

Research suggests that learning mathematics for understanding can change the beliefs that beginning teachers have about teaching the subject (Clarke, 2011) and a growth in knowledge and confidence can alter one's perceived identity (Stevenson, 2016). Reconstructing existing mathematical knowledge can result in a transformation of teaching approach (Stevenson, 2016), although this may not always be realised in the classroom (Clarke, 2009).

This review has identified that there is a gap in the literature on the identities of subject enhancement course participants and the influence of incoming identities in the negotiation of identities as a beginning teacher of mathematics (Hossain, Mendick and Adler, 2013). This study makes a contribution to addressing this identified gap.

The next chapter presents the research design, methodological tools and ethical considerations in this study.

Chapter 3: Methodology

3.1 Introduction to the chapter

This chapter begins with a discussion of the methodological approach, informed by my positioning, that frames this study. The design of the research is outlined with an overview of how the data collection tools were used and how the data were analysed. This chapter also includes a discussion of the choice of participants and how dependability, trustworthiness and ethical issues were considered within the research process.

The overarching aim of this study was to explore how being a 'subject switcher' (section 1.6) might influence the negotiation of identities as a teacher of mathematics. The research sub-questions (RSQs) outlined in Chapter 1 are:

1. What are the incoming identities of subject switchers embarking on a pre-initial teacher education subject enhancement course?
2. What identities do subject switchers negotiate during the subject enhancement course and initial teacher education?
3. What are the future-orientated identities of subject switchers as teachers of mathematics?

3.2 My positioning

Having a background in mathematics, I had thought that educational research methods would be concerned with analysing numerical data using mathematically-based methods. I had naively assumed that social research would automatically follow the same principles as the natural sciences, in attempting to discover 'laws' of individual and social behaviour. As a mathematician, I viewed the world as objective and generalizable and had been accustomed to seeking to generalise and explain situations through rules and formulae. However, as a secondary school teacher, and

more recently a teacher educator, it became clear to me that the complex behaviour of my students in the educational institutions to which they belong, could not be objective and generalizable nor could situations be explained through rules and formulae.

As an education researcher, my ontological position is that social reality cannot be entirely objective in nature, external to individuals and 'out there' to be objectively observed by us but that reality is, at least in part, constructed by individuals and their observations. Muijs (2004) considers the view 'that there is a true reality out there that we can measure completely objectively' to be problematic as 'we are all part of the world that we are observing, and cannot completely detach ourselves from what we are researching' (p. 4). Whilst I do believe that social reality is the 'product of individual consciousness' and the result of individual cognition and a creation of one's own mind (Cohen, Manion and Morrison, 2018, p.5), I also believe that individuals construct knowledge through their interactions with the physical and social world. Hence social reality is constructed to some extent by the individual and we construct truth socially through observations and discussions within the social orders and inherited realities that exist in our world.

> Reality, then, does not stalk around with a label. What something is, what it does, one's evaluation of it – all of this is not naturally preordained. It is socially constructed. (Apple, 2000, p. 43)

My ontological and epistemological position leads me to the opinion that research of human behaviour cannot be effectively studied through quantitative methods alone as 'individuals are unique and largely non-generalisable' (Cohen, Manion and Morrison, 2018, p.19). Hence, I agree with Bryman (2015, p. 24) that the social world cannot 'be studied according to the same principles, procedures and ethos as

the natural sciences'. As an experiment requires the control of behavioural events and it is my belief that human behaviour cannot be studied in this way, an interpretive approach is needed.

Whilst the realist view of a world existing independently of the researcher resonates with my experience of mathematics, I question how applicable this could be to the study of the social world of individual people and institutions. From an epistemological perspective, I consider that social knowledge cannot be 'hard, objective and tangible' as with the natural sciences but is instead, 'personal, subjective and unique' (Cohen, Manion and Morrison, 2018, p. 5) hence requiring alternative research methodologies. This shift in my positioning has resulted in an interpretative approach to the research.

3.3 An interpretivist approach

While the methods selected must be the ones that will be most effective in answering the research questions posed, based on my epistemological and ontological assumptions, this inquiry adopted an interpretative approach, focussing on perceptions which Cohen, Manion and Morrison (2018, p. 19) portray as being 'characterised by a concern for the individual'. Williams (2000, p. 210) describes interpretivism as 'those strategies in society, which interpret the meaning and actions of actors according to their own subjective frame of reference'. Therefore, my research approach is linked to the suggestion that an individual's values and beliefs directly affect their actions and that this may lead to more than one truth and that lived reality is socially constructed and involves listening to individuals, within a participatory framework. Thus 'the research participants are viewed as helping to construct the 'reality' with the researchers' (Robson, 2002, p. 27). Whilst the

interpretivist approach has been criticised for lack of rigour (Bernstein, 1975), this approach is the most appropriate way of understanding the lived experience of human subjects. In the context of this study, an interpretive approach will seek the perspectives and lived experiences of subject switchers (section 1.6) on their journey to becoming qualified teachers of mathematics.

3.4 Narrative approach

This interpretive study addresses the research questions, set out above, drawing on narrative inquiry. Narrative inquiry is a branch of interpretive research that can be defined as 'the process of gathering data through storytelling' (Shabani Varaki, 2007, para 4). Connelly and Clandinin (1990) present humans as 'story telling organisms' and describe the study of narrative as 'the study of the ways humans experience the world' (p. 16). Narrative is a process by which the researchers put themselves in the story of another individual to magnify the heard voice. The researchers then construct their own narrative of the story. The outcome of the research is a 'collaborative document, a mutually constructed story out of the lives of the researcher and participant' to produce a story that is authentic (Connelly and Clandinin, 1990, p. 12).

A range of narrative data were collected and analysed to consider the negotiation of professional identities for graduates of non-mathematical disciplines on their journey to becoming qualified teachers of mathematics, using Wenger's (1998) notion of trajectories, within the theoretical framework of communities of practice (Lave and Wenger, 1991). This involved considering participant stories of their prior experiences, their experiences of initial teacher education and their future-orientated aspirations and identities. The data sources from which the stories were constructed

included written statements, reflective journal entries, educational timelines, and transcriptions of interview conversations.

Whilst the prior experience of participants could be identified from the written data sources, further detailed information was needed to probe deeper into some of the experiences identified. Interviews were used as they gave the participants a voice to tell their rich story and, as identified by Wellington (2015, p.137), 'interviews can reach the parts which other methods cannot reach'.

3.4.1 Interviews

Interviews are based on conversations which Kvale (2007, p. 1) defines as a 'basic mode of human interaction':

> Human beings talk with one another, they interact, pose questions and answer questions. Through conversation we get to know other people, get to learn about their experiences, feelings and hopes and the world they live in. In an interview conversation, the researcher asks about, and listens to what people themselves tell about their lived world, about their dreams, fears and hopes, hears their views and opinions in their own words, and learns about their school and work situation, their family and their social life. (Kvale, 2007, p. 1)

An interview however is a specific form of conversation that goes beyond the usual every day interaction and exchange of views or opinions. Kvale (2007) presents the notion of an interview as an 'inter-view' in which 'knowledge is constructed in the inter-action between the interviewer and the interviewee' (p. 1) of the subject's 'life world' (p. 4). The interview has a structure and a purpose determined by the interviewer and the research interview is a 'construction site for knowledge' (p. 7).

Kvale (2007) offers two metaphors of the interviewer as 'a miner' or as 'a traveller', with the interviewer being a 'knowledge collector' or a 'knowledge producer' respectively (p. 22). The traveller metaphor 'leads to interviewing and analysis as

intertwined phases of knowledge construction, with an emphasis on the narrative to be told to an audience' (p. 20). I approached all stages of the interview inquiry with the conception of the interviewer as a traveller and ultimately a knowledge producer with a story to be told that is 'co-authored and co-produced by the interviewer and interviewee' (p. 89).

Webster and Mertova (2007, p. 88) state that 'ignoring the researcher's stories is both impossible and unsatisfying' and that 'in the telling of researcher stories, the stories of the participants merge with the researcher's to form new stories that are collaborative in nature'. Hence the outcome of the analysis is 'a collaborative document, in a mutually constructed story out of the lives of the researcher and participant' to produce a story that is authentic (Connelly and Clandinin, 1990, p.12).

Semi-structured interviews

The interview as a data collection tool provides a continuum of formality from the formal structured interview to the informal or unstructured interview. A structured interview will require a detailed schedule with questions asked in a specific order. Alternatively, an unstructured interview requires open ended questioning with no pre-determined structure. Whilst unstructured interviews have the potential to provide rich data, they require careful skill to ensure that relevant data is collected.

Whilst a tightly structured interview might achieve little more than questionnaire responses and an unstructured interview may not provide the focus needed, a semi-structured approach provides 'flexibility' in the order and range of questions within a loosely defined framework (Wellington, 2015, p. 141). The four issues identified by Wellington (2015) were considered when devising the semi-structured interview questions: 'the use of leading questions, open and closed questioning, ambiguity,

and the distinction between probing and prompting' (p. 145). As promoted by Kvale (2007) this inquiry utilised semi-structured interviews that were planned and flexible to obtain 'descriptions of the life world of the interviewee' so as to interpret 'the meaning of the described phenomena' (p. 8) and provide new insights.

The semi-structured interviewer aims to probe the answers given by the interviewee. In order to probe, the interviewer 'has to give something of himself' so as to merit an open response' (Sennett, 2004, pp. 37-38). The research interview however is not an open conversation between equal partners as there is 'an asymmetrical power relation' between the researcher and the subject (Kvale, 2007, p.14). The interviewer initiates, defines and terminates the conversation and so the interview is a one-way, instrumental dialogue where the interviewer has 'a monopoly of interpretation' (p. 15). Sennett (2004) describes the craft of in-depth interviewing as 'calibrating social distances without making the subject feel like an insect under the microscope' (p. 38). As with any power asymmetry there is the risk that subjects may tell the interviewer what they believe they want to hear. Kvale (2007, p. 15) suggests that researchers may reduce the power asymmetry by 'collaborative interviewing' where the researcher and subject approach questioning, interpreting and reporting as equals. Due to the demands on the participants' time while undertaking initial teacher education, I chose not to adopt a collaborative interview approach but I remained mindful of the social distances and aware of the power asymmetry and how this could potentially influence all stages of the inquiry.

Individual interviews

Whilst a focus group interview can be good for capturing viewpoints for exploratory studies (Kvale, 2007), it is recognised that group members may 'influence each other by responding to ideas and comments of others' (Krueger and Casey, 2000, p. 5) so

an obvious limitation of the group interview is that it can be difficult to determine the extent to which the viewpoint is shared. The views and experiences of individuals can bias the discussion and influence the findings. As I was concerned with examining individual experiences and perceptions, individual interviews were the most appropriate for this study.

The interview itself is just one stage of an interview inquiry which includes pre-interview and post-interview stages. Research interviewing has been referred to as 'a craft' (Sennett, 2004; Kvale, 2007) which is to be learned and practised in order to do 'good work' (Seidman, 2013, p. 140) in the interview process. There are practical, technical, conceptual and ethical issues involved in 'the craft of interviewing' (Kvale, 2007, p. xviii) and these will be explored throughout the relevant sections of this chapter.

3.4.2 Other narrative data sources

To complement the data from the interviews, a range of sources of written narrative were also collected. These written sources of data were 'naturally occurring' (Perakyla and Ruusuvuori, 2017) from the participants' engagement in the SKE and PGCE courses. These included written statements, reflective journal entries and a personal timeline constructed against relevant educational policy (section 3.6).

3.5 The participants

3.5.1 Choice of participants

The target group for participating in this study was postgraduate student teachers of secondary mathematics who had participated in an SKE course prior to commencing their PGCE course. As the overarching purpose of this inquiry was to gain an in-

depth understanding of how being a subject switcher might influence the negotiation of identities as a teacher of mathematics, it was essential to identify potential participants who were graduates of non-mathematical disciplines. In reflecting on the pilot inquiry, I identified the need to 'hand-pick' participants who were in 'possession of the particular characteristics being sought' (Cohen, Manion and Morrison, 2018, p. 218). Hence, convenience sampling was not appropriate for this study and 'purposive sampling' was undertaken so as to focus on the 'specific, unique issues or cases' (Cohen, Manion and Morrison, 2018, p. 218) of those with the characteristic of having alternative subject specialism prior to commencing initial teacher education in secondary mathematics.

'Naturally occurring' data (Perakyla and Ruusuvuori, 2017) from the application and selection process were considered to identify the prior experience of potential participants. Subject experience was determined by identifying the subject qualifications for each individual, with the title and content of any undergraduate or postgraduate degrees being an indication of subject specialism.

Subject specialism was categorised and defined as follows:

- 'Graduate of mathematics' – *degree is explicitly in mathematics*
- 'Graduate of mathematics-related discipline' – *degree includes significant aspects of mathematics (for example, STEM subjects: science, technology, engineering or mathematics)*
- 'Graduate of non-mathematical discipline' – *degree does not include significant aspects of mathematics.*

Those identified as graduates of non-mathematical disciplines, and hence having an alternative subject specialism, were approached directly with the opportunity to be involved in the research. All potential participants were provided with an information sheet (Appendix 3), outlining details of the study and offering the opportunity for a

face-to-face discussion and to ask questions. All of those identified as meeting the criteria of the purposive sampling agreed to take part in the study.

3.5.2 The participants

All four participants were graduates of non-mathematical disciplines and had participated in a mathematics subject knowledge enhancement (SKE) course prior to commencing their PGCE course. Despite these commonalities, the participants displayed a wide-range of personal and professional experiences which were explored through sources of narrative accounts and the construction of individual participant stories.

3.5.3 My positioning in relation to the participants

This inquiry was 'insider' research, due to my relationship with the participants as Head of Department for their initial teacher education course. Despite the ethical concerns, which are discussed later in this chapter, I consider my 'insider' status to be an advantage as I believe that my personal experience and understanding of the experience of the participants offers the opportunity for richer data. This provides an insight that Cousin (2010, p. 11) refers to as a 'special pair of glasses'. Although I am the Head of Department, I am not the course tutor and hence I am not involved in the day-to-day teaching and assessment on the initial teacher education courses. On reflection, this puts me in a position of both insider and outsider to the research. I am an insider in that I am known to the participants as the Head of Department and have involvement in the participants' progression to be recommended for Qualified Teacher Status (QTS). Equally, I am also an outsider in that I am not a member of the learning community to which the participants belong. Hence I can take

advantage of my ‘special pair of glasses’ without being too close socially to the participants in the research.

Le Gallais (2008, p.145) challenges the notion of absolute insider-ness or outsider-ness and describes her shift in positioning as becoming ‘less the objective stranger’ and ‘more the prophet in my own land’. Although my starting point was not as a complete outsider, I am aware that my positioning was not static and shifted as I engaged with the participants and became more familiar with their experiences and trajectories. I became an insider to a greater extent as I became more closely involved with the participants through in-depth individual interview conversations. This raised considerations for my shifting influence on the research. I planned and conducted the research on the assumption that reality is socially constructed and that social knowledge is subjective and unique. My ontological and epistemological positioning has influenced the choice of theoretical framework and the methodology of this study.

As well as considering the impact of personal reflexivity on the research, one should reflect on the impact that the research may have on the researcher, as both a person and a researcher. Engaging in educational research will have influenced and challenged my values, beliefs and identity.

> Epistemic reflexivity may reform the self as the forms of knowledge production processes in which an individual engages and knowledge-producing community in which an individual locates their research and themselves as a researcher are subject to change (Forbes, 2008, p. 450)

As captured in the title of a paper by Le Gallais (2008), *Wherever I go, there I am*, by taking a reflexive approach I am able to see myself, and my beliefs, in the design of the research. Keeping a research diary throughout the research process enabled me to remain aware of how I have influenced the research and equally how the

research has influenced my developing views and beliefs as a 'traveller' (Kvale, 2007).

> The journey may not only lead to new knowledge; the traveller may change as well. The journey might instigate a process of reflection that leads the traveller to new ways of self-understanding as well as uncovering previously taken-for-granted values and customs in the traveller's home country. (Kvale, 2007, pp. 19-20)

I am aware that who I am and how I see the world has influenced the way in which the research questions were written and how I designed the research.

3.6 Data collection

This section outlines the design of the research and provides an overview of how the data collection tools were used and how the data were analysed and interpreted. The participants were invited to take part in three phases of data collection as outlined in Table 4. Phase one consisted of access to a range of 'naturally occurring' narrative data (Perakyla and Ruusuvuori, 2017) from the participants' application to and participation in the SKE and the PGCE courses. This included written statements, reflective journal entries and a personalised educational timeline constructed by the participants. Phase two consisted of two activities designed to identify and categorise prior experience and to identify incoming, transitioning and future-orientated identities as a teacher of mathematics. Phase three consisted of individual semi-structured interview discussions to probe deeper into the themes identified in the phase one narrative and phase two activities.

Table 4: Data collection phases

	Phase 1	Phase 2	Phase 3
Nature of data collected	Naturally occurring data from the application process and the SKE and PGCE courses	Pre-interview activities	Semi-structured, individual interviews
Data sources collected	Written statements Reflective journal entries Educational timeline	Activity part 1: identify and categorise prior experience Activity part 2: Identify incoming, transitioning and future-orientated identities?	Transcriptions from audio-recordings of individual interviews

3.6.1 Data collection Phase 1

Written statements

All participants submitted a written personal statement during the application stage, outlining their reasons for choosing initial teacher education and their relevant experience and subject knowledge. This written narrative provided an overview, captured at the application stage, of participants' prior experience and reasons for choosing to train to teach secondary mathematics. Although it is accepted that the story one tells while applying for a place on a course may not be authentic, these accounts provided an additional layer of narrative to be considered alongside the other narrative data sources.

Reflective journal entries

Written reflective journal entries were made at key points during both the SKE course and the PGCE course. The prompts for the reflective journal entries can be found in Appendix 4. One participant took an online SKE with another provider and

was not required to submit reflective journal entries during the SKE course. All participants however completed reflective journal entries during the PGCE course.

The reflective journal entries captured participants' experiences and perceptions during their SKE and PGCE courses and identified what Denzin (1989) describes as the 'turning point moments' which 'leave marks on people's lives' and can 'alter the fundamental meanings and structures in a person's life' (p. 70). These reflective accounts were particularly helpful in identifying challenges and shifts in perceptions throughout the initial teacher education journey.

Educational timeline

All participants constructed a personalised educational timeline at the beginning of their PGCE course. Each participant mapped their own educational experience against a timeline of relevant educational policy. These timelines identified participants' experiences of their own schooling and higher education and how these were influenced by policy agendas at that time. These data provided crucial context to the narrative from the other data sources.

3.6.2 Data collection Phase 2

To inform the interviews, preliminary data were collected through pre-interview activities. The activities were designed to identify the individual experiences that participants have prior to entering initial teacher education and to identify the current, transitioning and future-orientated identities negotiated on their journey to qualified teacher status. The identification and categorisation of experiences and identities were used as a point of reference for the individual interview discussions.

Activity 1 part 1 – identifying and categorising prior experience

This activity was designed to identify participants' specific prior experience. Participants were asked to complete post-it notes identifying each of their relevant prior experiences and to arrange these into pre-determined categories. The categories given were: subject experiences, vocational experiences and personal life experiences. The opportunity was given for participants to modify or expand the titles of the categories but this was not felt to be necessary by any of the participants.

The post-it notes were arranged by category on the given templates and were photographed, with explicit written consent from the participants. The outcomes of this activity were used to inform the part 2 activity and the interview discussions.

Table 5: Activity 1 part 1 Identifying and categorising prior experience

Subject Experience	Vocational Experience	Personal Experience
Prior experience or specialisms in mathematics and/or alternative subjects i.e. subject experience and qualifications	*Prior vocational experience i.e. career, employment (paid or voluntary)*	*Prior personal experience i.e. experience of children/young people; sporting; coaching; clubs; other responsibilities*

Activity 1 part 2 – identifying prior, transitioning and future-orientated identities

Participants were presented with a template against which they identified their incoming, transitioning and 'future-orientated' identities (Lutovac and Kaasila, 2014). For example: I am a parent, I am an accountant; I am a classroom assistant; I am a student; I am a student teacher; I am a mathematician; I am a mathematics teacher.

The individually completed templates were photographed, with explicit written consent from the participants. The outcomes of this activity were used as a basis for discussion and reference during the individual interviews.

Table 6: Activity 1 part 2 Identifying incoming, transitioning and future-orientated identities

Incoming Identities	Transitioning Identities	Future-orientated Identities
<-Subject, vocational & personal->	<----SKE & PGCE courses---->	<-Designated identity of QTS->
-<----------Social Identities---------->		

3.6.3 Data collection Phase 3

Semi-structured, individual interviews

Whilst the phase 2, part 2, activity identified the incoming, transitioning and future-orientated identities for participants, follow-up individual semi-structured interviews were needed to probe deeper into some of the themes identified from the range of data collected.

The interview questions were designed to address the research questions. The questions were open in the form of 'tell me about…' The interview questions were piloted with a student from another cohort to ensure that they did not lead or prompt participants and that they were not ambiguous.

Individual interviews provided each participant with a voice to tell the story of their experience in rich detail. Semi-structured interviews provided flexibility within a loosely defined framework. Participants brought the outcomes of the part 2 activity to the interview as a basis for their story-telling and reference throughout the interview. Interview discussions were audio-recorded, with explicit written consent from the participants. Field notes were taken during the interviews to capture some features that an audio-recording could not, for example expression and non-verbal signals. The semi-structured interview prompts were of the nature, but were not limited to, the following: tell me about your prior experience, tell me about your

identities on the SKE and PGCE courses, and tell me about your future-orientated identities. The full set of interview prompts can be found in Appendix 5.

The narrative from each semi-structured, individual interview was transcribed verbatim by the researcher.

3.7 Analysis and interpretation of data

3.7.1 Coding the data

The narrative from all of the data sources were analysed by the researcher and coded according to themes arising from the data. An example of the coding from one of the interview transcriptions can be seen in Appendix 6. The coded narrative from the range of data sources reinforced, or diversified, the data from the stories told during the semi-structured individual interviews. These 'multiple sources of evidence' provided triangulation of data (Yin, 2018, p. 126) and improved 'the validity of research and evaluation findings' (Mathison, 1998, p. 13). These data and the themes arising from them were used to construct individual participant stories.

3.7.2 Participant stories

Participant stories were constructed by the researcher, drawing on the wide range of narrative data collected, coded and analysed. Draft participant stories were shared with the individual participants and final versions agreed, hence resulting in a 'mutually constructed story' that is 'authentic' (Connelly and Clandinin, 1990, p. 12). Full versions of the individual participant stories can be found in Appendix 7 and shorter versions are presented and discussed in Chapter 4 (section 4.2).

The narrative from the participant stories and the themes arising from the data were then analysed against Wenger's (1998) trajectories to identify how incoming

identities might have influenced the individual's journey and negotiation of identities as a teacher of mathematics.

3.7.3 Theoretical framework

The theoretical framework of learning and identity construction within communities of practice (Lave and Wenger, 1991; Wenger, 1998) was used to consider the transitioning identities of the participants of this study. A community of practice is defined by Lave and Wenger (1991) as 'a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice' (p. 98).

The participants of this study had been members of various communities of practice and had entered the communities of practice associated with their initial teacher education. Each had participated in an SKE course prior to embarking on a PGCE course, involving school placements, with the designated future identity as a qualified teacher of mathematics.

According to Wenger, identity is a learning process, a 'constant becoming' and 'something we constantly renegotiate during the course of our lives' (Wenger, 1998, p. 154). Individuals take multiple paths that lead to the formation of new identities. Wenger refers to these paths as 'trajectories' and describes identity as 'a trajectory in progress that includes where you have been and where you are going, your history and your aspirations' bringing 'the past and future into the experience of the present' (2000, p. 241). Wenger identifies five types of trajectories: peripheral, inbound, insider, boundary; and outbound (pp. 154-155). Table 3 provides an overview of Wenger's five trajectories.

These trajectories lead into and out of communities of practice. Individuals may belong to multiple communities and it is how they reconcile these multiple memberships that leads to developing identities. This process is ongoing as individuals move across boundaries from one community to another. Wenger (1998) refers to the 'nexus of multimembership' where 'multiple trajectories become part of each other, whether they clash or reinforce each other' (p. 159) hence constructing new identities as different forms of membership are reconciled.

Grier and Johnston's (2012) study of STEM professionals entering teaching, applied Wenger's five trajectories to conceptualise the career changers' pathway to teaching. This conceptualisation is shown in Figure 1. Grier and Johnston claim that it is 'important to understand how career changers negotiate their past and potential futures' in the process of becoming teachers (2012, p. 23). Whilst there has been an increase in the numbers taking subject enhancement courses and limited published literature on the professional identities of SKE participants, I argue that it is equally important to understand how those with alternative subject specialisms negotiate their past and potential futures in the process of becoming teachers of mathematics.

I adapted Grier and Johnston's (2012) conceptualisation of the career changers' pathway to teaching to consider how Wenger's (1998) notion of trajectories applies to the pathway taken by subject knowledge enhancement participants, with alternative subject specialisms, as they train to become teachers of mathematics. A diagram of this conceptualisation is shown in Figure 2.

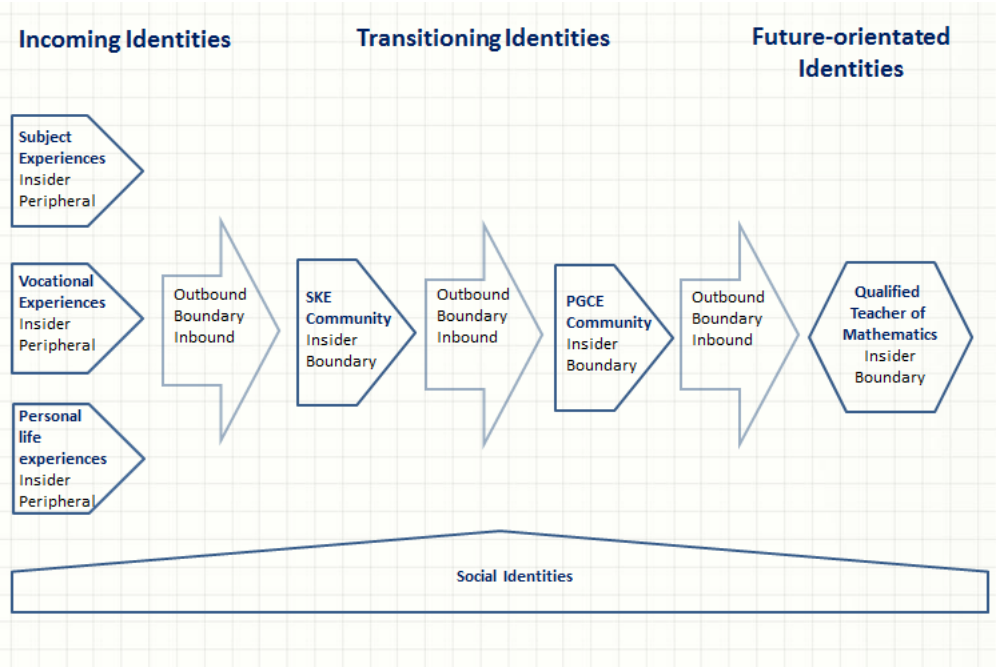

Figure 2: Conceptualisation of Wenger's trajectories and the SKE participants' pathway to teaching

This framework was used to analyse the trajectories of SKE participants as they negotiate identities in the transition to becoming a qualified teacher of mathematics. Table 7 provides an interpretation of Wenger's (1998) trajectories in the context of the participants of this study.

Table 7: Trajectories of SKE participants

Type of trajectory	Wenger's (1998) trajectories in the context of the participants of this study
Peripheral	Peripheral trajectories may include life experiences and membership of communities; including family groups, social groups and academic groups.
Inbound	The participants have inbound trajectories to their initial teacher education courses and to the teaching profession.
Insider	The participants have insider trajectories from their prior and existing academic, vocational and social communities of practice. They will become insiders in the SKE and PGCE communities and in the future they may have insider trajectories as qualified teachers in a school community of practice.
Boundary	Complex links will be made between participants' prior and existing membership of communities and their new inbound communities (i.e. SKE, PGCE and the teaching profession).
Outbound	Participants' prior and current engagement in academic, vocational and social communities will influence their engagement in new communities (i.e. SKE, PGCE and the teaching profession).

3.8 Ethical considerations

This section outlines how the ethical considerations of this inquiry were addressed within the research process. It is split into three sub-sections: ethical procedures, informed consent and the right to withdraw, and confidentiality and anonymity.

3.8.1 Ethical procedures

The British Educational Research Association's (BERA) *Ethical Guidelines for Educational Research* (BERA, 2018) were used as the basis for the ethical considerations of this research and to inform decisions regarding the research design. The ethical procedures of the University were followed and an application for permission to conduct the research was approved through the university's formal ethical approval process (Appendix 2). The main ethical concerns were related to consent, confidentiality and anonymity.

3.8.2 Informed consent and the right to withdraw

As per BERA guidelines (2018, p. 9, guideline 8), voluntary and informed consent for participation in the study was gained prior to the data being collected. Participants were provided with 'adequate knowledge' and 'information about the research project' (Brooks, te Riele and Maguire, 2014, p. 80) in the form of an information sheet providing details of the research (Appendix 3). Participants were also given the opportunity to ask questions about their involvement in the study. All participants signed a copy of the participant information sheet to indicate consent for their participation. This included explicit consent for audio recording interviews and photographing the outcome of paper-based activities. The ways in which the data were to be stored, analysed and reported were discussed and consent given.

Participants understood that their participation was voluntary and were informed that they had the right to withdraw from the study at any point without giving reasons (BERA, 2018, p. 18, guideline 31).

Despite ensuring that participants had as much information as possible and had voluntarily consented to their participation, I understood that ethical concerns were to be ongoing throughout all stages of the research process and employed what Skanfors (2009) described as an 'ethical radar' throughout the research process so as to identify any further ethical issues as they arose.

3.8.3 Confidentiality and anonymity

Issues of confidentiality and anonymity were addressed on the participant information sheet. These issues were also discussed with the participants and the opportunity to ask questions was provided. One of the main ethical considerations was my position as an 'insider' to the research and the impact of my relationship with the participants. This was openly discussed with participants from the outset of involvement and throughout the data collection, analysis and interpretation stages.

As the participants of the research were known to me, anonymity was not possible during the data collection stage. However anonymity and confidentiality were achieved in the data analysis and reporting through the use of pseudonyms for the participants, although it was recognised that certain identifying features that were key to this study, such as prior experience, could not be anonymised.

3.9 Validity and reliability (dependability and trustworthiness) of the data

Whilst the reliability and validity of narrative research has been questioned by educational researchers (Craib, 2000; Frosh, 1999) it is argued that 'reliability and

validity become redundant notions, for every interpersonal situation may be said to be valid' (Cohen, Manion and Morrison, 2000, p. 282) and that narrative analysis provides 'interpretation to a deeper level of understanding and meaning' (Shabani Varaki, 2007, para. 26).

In narrative inquiry, reliability refers to the 'dependability of the data' and validity refers to the 'trustworthiness of the data' (Webster and Mertova, 2007, p. 89). Narrative research does not produce generalizable truths and hence validity is more concerned with the research being supported and well-grounded by the data collected. Whilst triangulation is a common approach for ensuring the validity of qualitative data, it involves a variety of data sources. Whilst all of the data sources in this study were narrative in nature, a variety of sources of narrative data were collected to attempt triangulation. Flick (2018) suggests that triangulation is an 'alternative' to validation rather than a strategy for validation (p. 192).

> By having a cumulative view of data drawn from different contexts, we may… be able to triangulate the 'true' state of affairs by examining where the different data intersect. In this way… triangulation may improve the reliability of single method. (Silverman, 2000, p. 121)

Reliability of narrative data can be measured by the accuracy and accessibility of the data. All of the original written narrative data sources are available, as are the verbatim transcripts of the semi-structured interviews.

Lincoln and Guba (1985) describe the issue of trustworthiness in qualitative research as:

> The researcher must show that he or she has represented those multiple constructions adequately, that is, that the constructions… are credible to the constructors of the original multiple realities. (p. 296)

The trustworthiness of this research is achieved by the participants verifying their stories. Despite this, my status as Head of Department and my relationship to the

participants required further consideration. This relationship may have influenced whether individuals agreed to participate and in participating how authentically they responded during interview discussions. However, the triangulation of data sources that were naturally occurring at key points during the SKE and PGCE courses reinforced, or diversified, the stories told during the semi-structured individual interviews.

Generalisations are not possible as this interpretative study captures the stories of four individuals on their journey to qualified teacher status. Despite the limitations of the small number of participants and the nature of the narrative data collected to compile individual participant stories, this study contributes unique knowledge to an identified gap in the literature on the identities of subject enhancement course participants in initial teacher education.

3.10 Conclusion to the chapter

This chapter has outlined and discussed the methods, research design and ethical considerations of this narrative inquiry, framed by my positioning as a researcher.

The following chapter presents the findings of the study in the form of stories constructed by the researcher, and endorsed by the participants, from the range of narrative data sources collected. The stories represent the individual lived experiences and the perceptions of each participant on their journey to becoming a qualified teacher of mathematics. Chapter 4 also considers the commonalities and exceptions in experience and perceptions, through themes arising from the data.

Chapter 4: Findings

4.1 Introduction to the chapter

This chapter presents the participants' narratives of their individual journeys to becoming qualified teachers of mathematics. Narratives drawn from a range of qualitative data sources have been used to construct four individual participant stories, in the context of 'subject switchers' becoming teachers of mathematics. Table 8 is the key used throughout the remaining chapters to represent each data source.

Table 8: Data sources key

Date of Source (timeline)	Data Source	Key
Application stage	Application Form	APP
Application stage	Personal Statement	PERS
During the SKE course	SKE Reflective Journal 1	SKE RJ1
During the SKE course	SKE Reflective Journal 2	SKE RJ2
During the SKE course	SKE Reflective Journal 3	SKE RJ3
During the SKE course	SKE Reflective Journal 4	SKE RJ4
Start of the PGCE course	PGCE Reflective Journal 1	PGCE RJ1
Early in the PGCE course	Educational Timeline	EDT
Early in the PGCE course	Activity 1	ACT1
Early in the PGCE course	Activity 2	ACT2
Early in the PGCE course	Interview 1	INT1
First school placement	Interview 2	INT2
First school placement	PGCE Reflective Journal 2	PGCE RJ2
Second school placement	PGCE Reflective Journal 3	PGCE RJ3

The full participant stories can be found in Appendices 7a–7d and shortened versions of these stories are included in this chapter (section 4.2). Each participant story identifies personal, educational, and vocational experiences in relation to the journey to becoming a teacher of mathematics. Participants' identities, in the context of initial teacher education, are also presented.

Following the presentation of the four participant stories, the findings in terms of themes arising from these data are highlighted. The findings are structured under the following headings:

- Prior experience (section 4.3)
  - Being a learner of mathematics
  - Subject specialism
  - Vocational experience
  - Other relevant experience
- The journey to becoming a qualified teacher of mathematics (section 4.4)
  - Incoming identities
  - Transitioning identities
    - The Subject Knowledge Enhancement (SKE) course
    - The Postgraduate Certificate in Education (PGCE) course
  - Future-orientated identities

I have chosen to structure the findings in this way so as to best capture the lived experiences of the participants, which are complex and overlapping.

The overarching research question was: 'How does being a subject switcher influence the negotiation of identities as a teacher of mathematics?' The first heading above, 'prior experience', identifies the personal experiences of the participants as essential contextual information for research sub-question 1 (RSQ1) which is concerned with the incoming identities of the participants. The second heading, 'the journey to becoming a qualified teacher of mathematics', begins to address the research sub-questions. This section explores the incoming identities of the participants (RSQ1), the identities that subject switchers negotiate throughout their SKE and PGCE courses (RSQ2), and their future-orientated aspirations and identities as qualified teachers of mathematics (RSQ3).

4.2 Overview of the participants

In this section, I present short versions of the participant stories for the participants to whom I gave pseudonyms: Alice, Andrew, Christine and Deborah. Each participant story identifies relevant personal experience and explores the individual's journey to becoming a qualified teacher of mathematics. The stories draw on the range of data sources given in Table 8 (section 4.1). Participants' incoming, transitioning and future-orientated identities, in the context of becoming a teacher of mathematics, are also presented.

4.2.1 Alice's Story

Alice is a 25 year old female, with prior experience of teaching mathematics in a secondary school as an unqualified teacher. Alice is a graduate of Psychology and participated in a 28-week SKE course prior to commencing a PGCE course.

School education

Alice was educated in the Netherlands, until she moved to the United Kingdom at the age of 13. Entering the English school system in year 9 and 'barely being able to speak English', Alice was referred to as an 'English as an Additional Language' (EAL) pupil (INT1). Alice felt that this impacted negatively on some teachers' perceptions of her academic abilities, explaining 'the teacher saw me as an EAL pupil, therefore according to her… low ability student. This was despite me showing her that I could achieve higher' (SKE RJ1). Alice stated, 'I've had teachers who negatively labelled me… they put me in a box' (INT1). However, Alice was supported by her English teacher who 'believed in me, despite the language barrier, and continually challenged me to get the best out of me' (PERS).

Despite these difficulties, Alice was successful at school and was entered a year early, in year 10, for GCSE mathematics. Although Alice 'loved mathematics and it literally was my favourite subject at school' (INT1), she does not feel that she was 'taught in the most creative or interactive way' (PGCE RJ1). Alice recalls having experienced many a 'monotonous' mathematics lesson and having 'enjoyed the mathematics itself, more than the lesson' (PGCE RJ1). Alice opted to study mathematics at A-level but after the first week 'decided against it' and 'just stopped', as she found that she 'didn't really understand it' (INT1). Alice attributes this to having been taught procedural mathematical 'methods' earlier in school, 'rather than for understanding' (INT1).

Alice refers to having secured a place at grammar school for her sixth form studies 'based on my intelligence and not background' and commented that 'the majority of pupils in this school are middle class and it took me some time to adjust to the different environment' (EDT). Alice describes herself as being of 'a lower socio-economic background' and identifies the important role of the educational maintenance grant and student finance in enabling 'someone who is not from a rich background to be able to study at a higher level without having to worry about financial constraints' (EDT).

Subject specialism

Alice is a graduate of Psychology and considered that her background in this subject would support her in understanding and supporting pupils. Although Alice considered her undergraduate studies to have supported the development of her 'statistical knowledge… for teaching maths' (PERS), she considered herself as 'not having a mathematical background' (PGCE RJ1). Alice acknowledged that she had 'gaps in

mathematical knowledge' (SKE, RJ3) and that she needed to take an SKE course in preparation for initial teacher education.

Vocational experience

Alice undertook part-time waitress and bartender work while she was at university and has experience of working with children and young people, aged 11-19 years, as a volunteer at her local church, delivering theology lessons. Alice also has experience of leading a youth dance group. Alice has also worked part-time as a supply teacher and as a mathematics and English tutor.

Alice worked for one year as an unqualified mathematics teacher in 'a very challenging secondary school' (PERS). The intention had been that Alice would commence an employment-based initial teacher education course and complete an SKE course alongside her training. Unfortunately, due to a change in circumstances, the school was unable to support a trainee teacher. As Alice had already commenced employment at the school, she decided to continue for the year as an unqualified teacher. Alice refers to this experience as being 'drawn into the deep, not really having any training whatsoever' (INT1).

Alice considers her lived experience as a teacher to be an advantage in training to be a teacher on the PGCE course as she knows the school environment and can draw on her prior experience. Alice also considers that there are disadvantages in her experience of teaching in a challenging school in that she needs to 'unlearn' some 'bad habits' (INT1).

The journey to becoming a qualified teacher of mathematics

Alice attributes her reasons for wanting to become a secondary school teacher to her experience of working with young people and the impact of her own school teachers.

Alice recalls the passion and enthusiasm of a teacher who inspired her to teach. Alice also acknowledges the positive influence of a family member becoming a teacher. Alice acknowledges that the bursary for attending the SKE course was important and that she wouldn't have been able to afford to do the SKE without the government funding.

Alice notes that 'returning to mathematics as an adult has, at times, been hard' but considers the SKE course to have 'been very significant' in improving her mathematical understanding and confidence (SKE RJ3). Alice considered one of her biggest challenges to be that she has 'not done a maths degree', unlike many other participants in mathematics initial teacher education. However, Alice considers that having been a recent learner of mathematics has put her in a 'special position' for supporting 'pupils who struggle with mathematics' (PGCE RJ1).

Identities

Alice considers herself to be switching her specialist subject in training to become a teacher of mathematics. During the PGCE course, Alice did not yet consider herself to be *a mathematician*, nor *a mathematics specialist*. Alice described herself as *a trainee teacher*, or *a teacher*, drawing on her prior experience of working as a teacher in a secondary school.

Alice draws on her own background and experiences of her own teachers when describing the type of teacher that she wants to be, in particular, 'a mathematics teacher that genuinely cares about students, irrespective of their socio-economic background' (PGCE RJ1).

Regarding her future-orientated aspirations, Alice considered her background in Psychology would be an advantage in supporting pupils. Alice also draws on her

prior subject specialism, of Psychology, when describing her aspirations to be further involved in the pastoral side of education.

4.2.2 Andrew's story

Andrew is a 35 year old male, with prior career experience in customer services. Andrew is a graduate of Business Management and Information Technology and participated in a 28-week SKE course prior to commencing a PGCE course.

School education

Andrew's 'joy of maths started in primary school' (PERS1) and he describes himself as 'always being more interested and drawn to numbers and figures, than anything else' (PGCE RJ1). Andrew attributes this to the positive influence of both of his parents 'working in financial sectors while I was growing up' (PGCE RJ1).

Andrew had positive and negative experiences of learning mathematics at school. Andrew recalls his first mathematics teacher as 'such a good teacher' who he 'looked up to' and he 'always looked forward to his lessons' (SKE RJ1). However, Andrew describes his later teaching of mathematics as being 'textbook orientated' with 'not a lot of practical lessons'. Andrew felt that this 'classical style' of teaching mathematics 'hindered my progress as I am a practical learner' (EDT).

Andrew opted to study mathematics at A-level but, after the first term, was told by his teacher 'not to carry on… because he would fail' (INT1). Andrew continued with statistics only, 'because I was doing better at statistics' (INT1). As Andrew moved through his schooling, he focused more on 'business and especially the management side of things' (PGCE RJ1) which was subsequently the focus of his undergraduate studies.

Subject specialism

Andrew is a graduate of Business Management and Information Technology, and notes that this included aspects of mathematics, in particular finance, economics and statistics. Andrew acknowledges that he took an SKE course 'to improve and enhance my subject knowledge' (PGCE RJ1).

Vocational experience

Inspired by his parents' work in finance, Andrew had explored a career in accountancy. However, after undertaking one week's work experience with an accountancy firm he 'realised that it really was not for me at all' (PGCE RJ1). Andrew had struggled to decide on a career and having graduated in Business Management and Information Technology, he found himself 'moving from job to job, trying to find my place within the workplace' (PGCE RJ1).

Andrew eventually 'found my place within the world of telecommunications, specifically within the customer service sector' (PGCE RJ1). Andrew considers that he developed many skills through his work in customer services that are transferrable to teaching, such as 'empathy and patience', 'people skills' and the 'ability to communicate' (PGCE RJ1).

The journey to becoming a qualified teacher of mathematics

Becoming a father for the first time shifted Andrew's focus to wanting to find 'a stable career to be able to provide for my child' (PGCE RJ1). Andrew considered 'becoming a teacher' (PGCE RJ1) over ten years ago and states that 'teaching has been a dream for a long time' (PERS). Andrew waited for some time, while personal situations settled, to be in the 'right position to be ready for this challenge' (PERS). As a mature career changer, with extensive prior work experience, Andrew was keen

from the outset of his PGCE course to get into school and start teaching, stating 'just chuck me in at the deep end' (INT1).

Identities

Andrew is a career changer who has previously developed vocational skills that are transferrable to teaching. Andrew described himself as *a trainee teacher*, rather than *a student*, noting the differences between being an undergraduate student and training to be a teacher as a mature career changer.

Andrew considers himself to be switching specialist subject in training to become a teacher of mathematics. During the PGCE course, Andrew did not yet consider himself to be *a mathematician*, nor *a mathematics specialist*, stating that he is 'not a mathematician or a specialist, like some of the people… who've done a maths degree and things like that' (INT1).

In describing his future-orientated aspirations, Andrew expresses that first and foremost he wants to be 'a good teacher' and would 'rather be a teacher that specialises in mathematics' than 'a mathematics teacher' (INT1).

Andrew also refers to an inspirational mathematics teacher from his early schooling and hopes to 'be like the exemplary teacher… and have pupils remember me and my lessons for years to come' (SKE RJ1) and to 'have left a lasting impression on them' (PGCE RJ1).

4.2.3 Christine's story

Christine is a 25 year old female, who is a graduate of Business Management. Following the completion of her degree, Christine participated in a 28-week SKE course prior to commencing a PGCE course.

School education

Christine was educated in India until the age of 18, when she migrated to England. Christine had 'always enjoyed mathematics' (PERS) and wished to pursue this subject post-16. However, a move to another school in India at the age of 16, and a change in the mathematics curriculum, meant that she was unable to continue studying mathematics and pursued Business Management instead. Christine explains that she 'did Business just because I couldn't do maths, but always wanted to do maths' (INT1).

Subject specialism

Christine is a graduate of Business Management and her highest formal mathematics qualification is equivalent to GCSE level. Shortly after completing her degree, Christine participated in a 28-week university-based subject knowledge enhancement (SKE) course in mathematics, prior to commencing a PGCE course.

Vocational experience

Christine had some part-time experience of working in retail, whilst she was a student, and considers that she has acquired skills that are transferrable to teaching, such as 'communication skills' and 'interacting with people' (INT1).

Having started the SKE course immediately after completing her degree, Christine has not had an alternative career and did not consider careers other than teaching, as she had 'been very passionate about teaching and education from a young age' and her 'dream is to become a teacher' (PGCE RJ1).

The journey to becoming a qualified teacher of mathematics

Christine admits that 'when I first came to this country… no one was here to help me. My parents weren't that educated, so nobody was there to give me support or to

know which way to go' (INT1). Christine got married and notes the positive influence of her husband in advising her of 'various education paths' (INT1) and supporting her to pursue a career in teaching.

Christine undertook four weeks voluntary experience in two different secondary schools in England, prior to starting her initial teacher education and considers that this experience supported her understanding of schools in this country. This experience helped Christine to confirm that 'I want to go and pursue this career' (INT1).

Christine refers to her own family background and 'financial conditions' when describing her motivation for a career in teaching, stating that she wants 'to be in a profession [in] which… I can set an example for my future generation' (INT1).

Identities

Christine notes the significance of the SKE course in her journey to becoming a teacher of mathematics, 'otherwise… I wouldn't have been in this journey, I couldn't be a teacher' (INT1).

Although Christine does not consider herself to be *a mathematics specialist*, nor *a mathematician*, she does not consider herself to be switching specialist subject either. Christine always wanted to study mathematics but was unable to continue with the subject post-16 due to changes in her schooling at that time: 'It was because of some circumstance that I had to change my course, change my subject, but I always wanted to do this' (INT1).

Christine describes her identity whilst participating in the SKE course as *a learner* and in particular, *a subject learner* or *a learner of subject knowledge*. On the PGCE

course, Christine still refers to herself as *a learner* but notes the difference between being a learner of subject knowledge on the SKE course and learning to be a teacher on the PGCE course. Christine refers to an immediate shift in her identity from *a student* to *a professional* on starting the PGCE. Early in the PGCE course, Christine did not yet view herself as a teacher because she had not yet started her placement in school and was not in the school community of practice. Christine does however refer to herself as *a trainee teacher.*

When talking about her future-orientated identities, Christine states that she wants to be 'a mathematics teacher with good subject knowledge' (ACT2), bringing together having been 'a learner of subject knowledge' on the SKE course and 'learning to be a teacher' on the PGCE course (INT1). Christine states that she 'would be confident to teach GCSE, not A-level' but indicates a desire to continue to enhance her subject knowledge for teaching, possibly by undertaking a mathematics degree, and her future-orientated aspiration is 'to become a proper mathematician' (INT1).

4.2.4 Deborah's story

Deborah is a 28 year old female, with prior career experience as a manager in the retail sector. Deborah has a Bachelor's degree and a Master's degree in Politics and an AS-level in mathematics. Deborah participated in a 28-week, online SKE course prior to commencing a PGCE course.

School education

Deborah describes herself as having a 'challenging background' (PGCE RJ1) and 'coming from a family of limited resources' (PERS). In considering her own educational timeline, 'the factor that most influenced my time in education was the

investment in the school system, including the educational maintenance allowance and free school meals' (EDT).

Deborah had 'always liked maths' (INT1) and comments that it was 'one of my favourite subjects in school' (PERS). She describes herself as having 'been classed as a STEM student' and that 'up until the age of seventeen I would have defined myself as mathsy-sciencey' (INT1).

Deborah was entered to take GCSE maths early in Year 10 and opted to study mathematics A-level. Despite having been successful in mathematics until aged 16, Deborah 'really struggled' with A-level maths 'because the teaching really changed' (INT1). Deborah attributes this to a change in mathematics teacher and teaching styles, stating 'it definitely was a step up and reflecting back on it, I didn't enjoy the teaching styles in A-level' (INT1). Deborah feels that she 'got left behind' (PGCE RJ1) and comments that some of the underpinning mathematical concepts were missing which meant that she couldn't cope with the step up to A-level. Deborah continued with mathematics up to AS-level but did not continue with the full A-level as originally planned. After completing her A-level studies, Deborah studied Politics at university.

Subject specialism

Deborah is a graduate of Politics at both Bachelor and Master's level. Her highest formal mathematics qualification is AS-level. Deborah participated in a 28-week online subject knowledge enhancement (SKE) course in mathematics prior to commencing her PGCE course.

Vocational experience

Deborah undertook part-time work in shops and cafés while she was a student. Following the completion of her Master's degree, Deborah completed a 'fast track management scheme' with a well-known supermarket chain (INT1). Deborah worked as a department manager in the retail sector for over five years before retraining to become a mathematics teacher. Deborah refers to the satisfaction she experiences from training colleagues and cites this as one of her motivations for 'consider[ing] teaching as a career' (PERS). Deborah considers that she has developed many skills during her career in retail that are transferrable to teaching, including supporting members of her team with pastoral issues.

The journey to becoming a qualified teacher of mathematics

Of her career in retail management, Deborah 'enjoyed that every day was different' and 'loved the unpredictability of her work' (INT1). However, she found that other people had negative perceptions of her chosen career given that 'you went to university… to then go and work in a shop' (INT1).

Changes in the retail industry, a growing disillusionment with her career in retail management, and a desire to 'do something that's got more value to it' led Deborah to start 'looking for other things that I could do with my degree' (INT1). Deborah cites her prior experience of training colleagues as a positive influence in deciding to retrain as a teacher. Deborah also found that having 'friends who were teachers, who really like what they do' had a positive influence on her decision to train to become a teacher.

Identities

Deborah completed an SKE course online prior to commencing a PGCE course. As a career changer, the online SKE course allowed Deborah to continue working full-time alongside undertaking her SKE course. Deborah refers to the SKE course as being 'really valuable' and 'one of the best things that I've done' (INT1).

Deborah refers to herself as *a non-mathematician* and comments on being such in a cohort of mathematics graduates training to be teachers. Deborah considers herself to be *a subject switcher* but acknowledges that she may consider herself to be *a mathematics specialist* in the future.

Deborah describes her identity whilst doing the SKE course as *a student* and she considers herself to still be *a maths learner*.

Deborah describes her identity on the PGCE course as *a trainee teacher,* rather than *a student*, and explains that having had a previous career influences this, compared to those on the PGCE course who are not career changers.

Deborah's future-orientated identities draw on her prior subject and career expertise. Despite her shift to mathematics, Deborah still holds a potential place for her prior subject specialism, of Politics, in her future teaching career stating, 'if I could draw up the ideal job, I'd love to be able to teach maths and maybe do Politics A-level' (INT1).

Deborah draws on her own social background of 'coming from a family with limited resources' (PERS) when describing the type of teacher that she would like to be: 'I have a challenging background and I have achieved many of my dreams. I want my students to believe they are capable of anything they want, too' (PGCE RJ1).

Deborah also says that she is ‘keen to make a difference and give everyone a fair chance in life’ and that ‘as a maths teacher I could really make a difference and support my students’ and ‘inspire a passion and interest in maths’ (PERS).

Deborah’s future-orientated aspiration is ‘to develop into a head of subject and potentially one day to be an assistant head teacher’ (PGCE RJ1). Deborah explains how her future-orientated aspirations bring together her incoming identity as a manager and her current identity as a trainee teacher. ‘I enjoyed leading and managing people and pushing people’s personal development… long term I would like to be in senior management in school… and I think that marries the two things together’ [points to prior identities and current identities on ACT2] (INT1).

4.3 Prior experience

The prior experiences of the four participants are considered under the following sub-headings, arising from the data: being a learner of mathematics, subject specialism, vocational experience, and other relevant experience.

4.3.1 Being a learner of mathematics

A summary of the participants’ experiences of learning mathematics, and the emerging themes, can be found in Table 9.

Early enjoyment of mathematics

All four participants claim to have ‘always enjoyed mathematics’ (Christine, PERS) and state that it was one of their ‘favourite subjects in school’ (Deborah, PERS). As Alice stated, ‘when I was at school, I loved maths and it literally was my favourite subject’ (Alice, INT1). Andrew refers to the nature of mathematics and reflects that

he ‘was always more drawn to numbers and figures, than anything else’ (Andrew, PGCE RJ1).

> My joy of maths started in primary school, where I was quick at picking up times tables, and during a lesson about volume… I was taught a formula to calculate this without counting, which blew my mind. (Andrew, PERS)

Table 9: Experiences of learning mathematics

	Alice	Andrew	Christine	Deborah
Early enjoyment of mathematics	Yes	Yes	Yes	Yes
Negative experiences of learning mathematics	Yes	Yes	Yes	Yes
GCSE mathematics:				
Early entry for GCSE mathematics	Yes	No	No	Yes
Passed GCSE mathematics, or equivalent	Yes	Yes	Yes	Yes
Post-16 mathematics:				
Wanted to study mathematics at post-16	Yes	Yes	Yes	Yes
Experienced barriers to studying mathematics at post-16	No	No	Yes	No
Experienced difficulty with progression of mathematics study at post-16	Yes	Yes	N/A	Yes

Negative experiences of learning mathematics

Despite their described fondness of the subject, all of the participants also reflect on negative experiences of learning mathematics at school. Christine perceived this to be characteristic of secondary school education in the country in which she experienced her schooling, stating that ‘there is less creativity and more… just giving information and teacher-led classes’ (Christine, INT1). The other three participants experienced secondary school education in England and they also referred to not having been taught in a creative, or interactive way, or being taught methods rather than for understanding. Typically, Andrew described his school education in the following way.

> Sometimes there was just too much to take in from the lessons and, because it was mostly textbook work, it wasn't explained as well as it could have been. I feel that the education that I received was definitely more of a 'classical style', it was very textbook orientated, and there were not a lot of practical lessons, especially in mathematics, which I personally feel hindered my progress as I am a practical learner. (Andrew, EDT)

Despite negative experiences of learning mathematics at school, the participants had not disconnected from the subject itself. As Alice explains, 'although it was not taught in the most creative or often interactive way, I still enjoyed the mathematics itself more than the lessons' (Alice, PGCE RJ1).

GCSE mathematics

Alice and Deborah were entered to take GCSE mathematics a year early, in year 10, and were then entered for GCSE additional mathematics. Deborah explained that she did her GCSE in a 'condensed year' and that she was 'really pushed and really challenged' (Deborah, INT1). Alice reflects on her experience of being taught to pass the test.

> Towards year 10 it was just… do your GCSE in January… forget about maths. So after January that was it. So in year 10 I did my maths… sat the paper and then that was it. So it was really methods… okay you've got the exam coming up, this is what you need to learn, this is what you need to do. (Alice, INT1)

All four participants were successful in school mathematics and all gained GCSE, or equivalent, qualifications in the subject.

Post-16 mathematics

All four participants also initially opted to study mathematics at post-16. Christine explains that she was unable to pursue this choice due to circumstances regarding a change in her schooling overseas and hence, the mathematics curriculum she would study.

> I had to move to another state… and that boarding school was extremely different to the one I went to, where I did my secondary education… I wanted to do maths… and the curriculum was extremely different… therefore I couldn't cope with it… so I couldn't do that then because I have no basics… therefore I had to change it… because Business Management was new, it was *starting from scratch*, so I could do that. (Christine, INT1)

By using the term, 'starting from scratch', Christine refers to the subject of Business Management not relying on any prior knowledge, or experience of learning the subject. Hence there were no initial barriers to her studying this subject, unlike with mathematics.

Alice, Andrew and Deborah all commenced A-level mathematics but they all faced some difficulties with progression of their studies of this subject. Alice 'decided against it' and 'just stopped' her A-level mathematics studies, very soon after starting, stating her reasons as:

> I was just taught the methods and I didn't really understand it. Jumping from GCSE maths to A-level maths is a *big leap* and especially if you don't fully conceptually understand the mathematical processing, you really struggle. (Alice, INT1)

Andrew stopped studying A-level mathematics after the first term, on the advice of his teachers, but carried on with statistics at A-level.

> I did go on to do A-level maths but got told after the first… term not to carry on doing it all because I would fail and just to focus on statistics because I was doing better at statistics. (Andrew, INT1)

Deborah continued with and passed AS-level mathematics but did not continue with this subject for the full A-level, as she had originally intended.

> I really struggled because the teaching… really changed… it definitely was a *step up,* and reflecting back on it, I didn't enjoy the teaching… styles in A-level… there were a few of us that were really trying, but getting nowhere, and with A-level maths, if you haven't got the underpinning concepts you can't kind of go anywhere with it. (Deborah, INT1)

By using the phrases ‘big leap’ and ‘step up’, Alice and Deborah, respectively, refer to the ‘widely acknowledged difficulties’ and ‘problematic transition’ from GCSE to A-level mathematics (Mendick, 2008, p.711). Alice attributes this perceived gap to having been taught ‘methods’ rather than for ‘understanding’ during her school mathematics lessons (Alice, INT1). In both cases, the early entry for GCSE is perceived as hindering their progression with mathematics at post-16. For Alice, she had a ‘year and a bit’ where she ‘didn’t really do much maths’ (Alice, INT1) after taking the GCSE a year early. Deborah found studying the additional mathematics to be problematic.

> I don’t think doing additional maths in between helped because I quickly switched off from that because there were bits that were too difficult and I don’t think that helped. (Deborah, INT1)

The difficulties in progression in post-16 mathematics provided a significant turning point for all of the participants, in terms of their future studies. Andrew indicates that the difficulties in progressing with A-level mathematics were the reason ‘why I never carried on maths into university or anything’ (Andrew, INT1). Deborah describes a change of direction, and subject identity, at this point in her education:

> I would always have been classed as a STEM student… up until the age of seventeen I would have defined myself as mathsy-science. (Deborah, INT1)

Following their negative experiences of mathematics at post-16, all four participants pursued alternative subjects for their undergraduate studies.

4.3.2 Subject specialism

The mathematics qualifications, and alternative subject specialisms, of the participants are summarised in Table 10. All four participants have mathematics qualifications equivalent to at least GCSE level, with two participants having

mathematics, or mathematics related qualifications, at AS-level or A-level. All four participants are graduates of non-mathematical disciplines. Andrew and Christine have business-related degrees, whilst Alice and Deborah have degrees in the social sciences. Despite their alternative subject specialisms, they all chose to train to teach secondary mathematics.

Table 10: Subject qualifications and experience

	Alice	Andrew	Christine	Deborah
Mathematics qualifications	GCSE mathematics	GCSE mathematics and A-level statistics	GCSE mathematics (equivalent)	GCSE mathematics and AS-level mathematics
Subject of undergraduate degree	Psychology	Business Management and Information Technology	Business Management	Politics
Subject of postgraduate degree	N/A	N/A	N/A	Politics
Time passed between completing specialist subject studies and starting SKE	1 year	14 years	Immediately	6 years
Mathematics SKE course	28-week SKE course	28-week SKE course	28-week SKE course	28-week SKE course (on-line)
Fits definition of a 'subject switcher'	Yes	Yes	Yes	Yes

All four participants can be considered to be subject switchers. A subject switcher is my own term, introduced in this thesis (section 1.6) and defined as:

> A subject switcher is a participant in initial teacher training whose degree is in a discipline that is not directly related to the subject they are training to teach.

As subject switchers, all four participants engaged in a mathematics SKE course, prior to commencing their initial teacher education, as per the purposive sampling for

this study (section 3.5.1). Alice and Christine are recent graduates, having only one year or less between completing their degree studies and starting the SKE course. Andrew and Deborah are not recent graduates and have been employed, in sectors other than teaching, between their degree studies and starting the SKE course.

4.3.3 Vocational experience

The vocational experience of the participants has been summarised in Table 11. Three of the participants had vocational experience prior to commencing initial teacher education. Alice had been employed as an unqualified teacher in a secondary school, whilst and Andrew and Deborah had been employed in alternative careers. Although Christine had some work experience from part-time jobs, she had not had a prior career.

Table 11: Vocational experience

	Alice	Andrew	Christine	Deborah
Previous career	Unqualified teacher	Customer Service	N/A	Retail management
Time in previous career	1 year	14 years	N/A	6 years
Fits definition of a 'career changer'	No	Yes	No	Yes

Andrew and Deborah both had alternative careers, prior to training to become teachers. Andrew had fourteen years' experience working in customer services and Deborah had worked for six years as a department manager in the retail industry. Andrew and Deborah refer to themselves as career changers, as they had alternative careers prior to training to become teachers. As well as self-identifying as career changers, they both fit the definition adopted in this study as:

> A student who has worked for at least three years in a career other than teaching, including full or part time, paid or unpaid work, and/or parenting, prior to enrolling in their current teacher education course. (Williams and Forgasz, 2009, p. 97)

Alice and Christine do not fit this definition and do not consider themselves to be career changers. Alice had worked for one year as an unqualified teacher prior to commencing a SKE course and hence had vocational experience in the field of teaching. Christine commenced a SKE course immediately after completing her undergraduate degree and whilst she had some part-time work experience, she had not had a prior career.

4.3.4 Other relevant experience

The participants' other experiences, that are considered relevant to teaching, are summarised in Table 12 and include: working in schools, working with children or young adults, and parenting or caring.

Table 12: Other relevant experience

	Alice	Andrew	Christine	Deborah
Working in schools	Employed as a teacher (1 year)	Observation visits only	Observation visits only	Observation visits only
Working with children or young adults	Yes	Yes	Yes	Yes
Teaching or tutoring	Yes	No	Yes	No
Mentoring or training	No	Yes	No	Yes
Parenting or caring	No	Yes	No	No

Working in schools

All four participants spent some time in secondary schools in preparation for commencing their initial teacher education. As discussed above, Alice was employed as an unqualified teacher in a secondary school for one year. Whilst

Andrew, Christine and Deborah had not been employed in a school, they had all spent some time observing and supporting in secondary school classrooms prior to starting the SKE course. Christine commented that the school experience helped to confirm that 'I want to go and pursue this career' (Christine, INT1).

Working with children or young adults

All four participants had some experience of working with children, or young adults, prior to commencing their initial teacher education. Alice had extensive experience of working with secondary school aged children, both in and outside of the school classroom. Alice had experience of working with young people through her teaching and tutoring. She had also worked with children in social groups, undertaken voluntary theology teaching at her local church and worked with a youth dance group. Alice stated that she 'particularly enjoy[s] educating children' and that her 'numerous experiences in teaching have stimulated me to want to become a teacher' (Alice, PERS). Alice considered that as she had 'stood in front of children and taught them', teaching was 'just a natural progression from what I've done before' (Alice, INT1).

Andrew had also worked voluntarily with children in a social setting, supporting a Beaver Scouts group. It was through this work Andrew realised that he would like to work with children: 'I realised that I like being around kids. They're funny… they are the most interesting people' (Andrew, INT1).

Christine had some experience of voluntarily tutoring young people and whilst Deborah did not have experience of working with secondary school aged children, she did, like Andrew, have experience of training and mentoring young people in the

workplace. Deborah refers to her prior experience of training colleagues to be a positive influence in considering retraining to be a teacher.

> When I taught colleagues skills they had never done before, I found myself truly motivated and animated by their successes. Being able to celebrate success with the colleagues I have taught is one of my greatest achievements. It was this that made me consider teaching as a career. (Deborah, PERS)

Andrew considered that he had developed many skills through his prior career that would be transferrable to teaching.

> I have developed both empathy and patience during my extensive work in customer service… This has allowed me to greatly develop my people skills and ability to communicate with people of different backgrounds, ages and abilities meaning I can apply this to dealing with young people. (Andrew, PERS)

In particular, Andrew perceived that his experience of training and supporting colleagues and customers would support him as a teacher.

> I was teaching people in a way, explaining how to use their phones and opening their eyes to different things and ways they can do things with their phones, so I guess this combined with the people skills I learnt while doing this will be something that is invaluable to have when I move into the classroom. (Andrew, PGCE RJ1)

Parenting

Only one of the participants had experience of parenting. Andrew was a parent to two children and expressed the desire, when he first became a parent, to find a 'stable career to provide for my child' (Andrew, PGCE RJ1). As well as providing for his family, Andrew considered that becoming a teacher would also 'help with my own kids' (Andrew, INT1).

> I like teaching my daughter… she's at nursery… she's got these plastic shapes… and they stick together. While she's playing with them I'm like,

> What shape is this? How many sides has it got? So I'm… getting her to learn as many shapes as I can. (Andrew, INT1)

The participants' prior experiences contribute to their incoming identities as beginning teachers of mathematics, as explored in section 4.4.1.

4.4 The journey to becoming a qualified teacher of mathematics

This section presents an overview of the participants' identities in terms of their journey to becoming qualified teachers of mathematics. This section is structured in terms of incoming identities, transitioning identities, and future-orientated identities.

4.4.1 Incoming identities

The term 'incoming identities' (Friedrichsen et al., 2008) is used to refer to the existing identities of the beginning teachers when they commenced their initial teacher education, in the case of these participants when they started the subject knowledge enhancement (SKE) course. The participants in this study have wide-ranging prior experiences and hold multiple social and professional identities. The incoming identities that were significant in each participant story are summarised in Table 13.

Table 13: Incoming identities

Incoming identities	Alice	Andrew	Christine	Deborah
Parent	No	Yes	No	No
Teacher	Yes	No	No	No
Tutor	Yes	No	Yes	No
Mentor/trainer	No	Yes	No	Yes
Professional	No	Yes	No	Yes

The participants all had social identities relating to their individual characteristics such as gender, ethnicity, religion and social class. They also held social identities relating to the roles that they have held in social groups and communities.

As a father of two children, Andrew considers his identity as a parent supports his emerging teacher identity. Whilst Alice, Christine and Deborah are not parents, they all, like Andrew, have experience of working with children or young adults. All of the participants perceived that their experience of working with children or young adults supported their teacher identity.

Alice has an existing teacher identity due to her prior experience of working in a school as an unqualified teacher. Whilst Alice considered her experience working as a teacher to be an 'advantage', she also acknowledges that this has caused some tensions, such as some 'bad habits' that she needs to 'unlearn' as she develops further as a teacher (Alice, INT1).

Alice and Christine have identities as mathematics tutors to young people, whilst Andrew and Deborah have identities as mentors and trainers in the workplace. All participants perceive that the skills developed during their tutoring, mentoring or training roles were supportive of their teacher identity, even if the experience was with young adults rather than children. Also, it is these experiences that are cited as being positive influences in the participants' decisions to train to become a teacher.

As career changers, Andrew and Deborah have identities from their previous careers: Andrew in customer services and Deborah as a manager. Both Andrew and Deborah consider that many aspects of their prior career identities support their emerging teacher identities. Deborah, in particular, feels that her experience of dealing with young colleagues as a manager would support the 'pastoral' side of teaching (Deborah, INT1).

The participants all have experience of being learners of mathematics and experience of barriers to learning this subject. Their experiences of learning

mathematics have contributed to their mathematical identities. As 'subject switchers' (section 1.6), the participants have alternative subject identities as well as mathematical identities. Their subject identities are based on their experiences, both the successes and the difficulties, of learning the subject and their membership of academic and social subject communities.

4.4.2 Transitioning identities

This section presents an overview of the participants' identities during their SKE and PGCE courses. Professional identities for a beginning secondary school teacher of mathematics include teacher identity and subject identity, in particular mathematical identity.

As all four participants are graduates of non-mathematical disciplines, they all participated in an SKE course, prior to commencing initial teacher education. All four participants undertook a 28-week SKE course prior to starting a PGCE course. The routes taken to QTS are summarised in Table 14.

Table 14: Route to Qualified Teacher Status (QTS)

	Alice	Andrew	Christine	Deborah
Mathematics subject knowledge enhancement (SKE) course	SKE course 28 weeks	SKE course 28 weeks	SKE course 28 weeks	SKE course 28 weeks (on-line)
Initial teacher education (ITE) course	PGCE course 40 weeks	PGCE course 40 weeks	PGCE course 40 weeks	PGCE course 40 weeks

This section is split into two sub-sections: the SKE course and the PGCE course.

The Subject Knowledge Enhancement (SKE) course

All four participants valued the SKE course and recognised the important role this played in developing their mathematics subject knowledge and understanding for

teaching. Alice and Andrew noted the change in their knowledge and understanding of mathematics. For Andrew, this built on the mathematical 'base knowledge' learned from his own schooling, which he describes as now 'having grown dramatically' (Andrew, SKE RJ4).

Drawing on her prior experience of being taught to pass an examination, Alice stated, 'the SKE course helped me to understand, more than just get the methods memorised' (Alice, INT1) and said that the 'course has been very significant to my mathematical learning… I have seen a massive improvement in my mathematical understanding' (Alice, SKE RJ3). Alice comments on the impact of her enhanced mathematical understanding on her confidence as a mathematical thinker.

> This has helped motivate me as it gave me more confidence in mathematics… it has given me a great feeling of accomplishment and achievement… this helped me become more of a mathematical thinker. (Alice, SKE RJ3)

Christine and Deborah note the significant role of the SKE course in preparation for initial teacher education. Deborah refers to the SKE course as 'really valuable' and 'one of the best things that I've done'. She comments that she 'wouldn't have been prepared [for the PGCE course] having not done something that good' (Deborah, INT1). Similarly, Christine states that without the SKE course she 'couldn't have been a teacher' (Christine, INT1).

Alice, Andrew and Deborah note that returning to being a learner of mathematics was hard work, as they had expected it to be, but recognise the mathematical knowledge and understanding the SKE course had equipped them with. Alice identified what she perceives to be the 'special position' of SKE participants entering mathematics teaching.

> I believe I am in a special position as I have experienced mathematics as easy and hard. In school, mathematics came easy to me… returning to mathematics as an adult has at times been a bit harder than I recall it being in school. I was able to work hard at it and enjoy the rewards of solving mathematical problems. (Alice, PGCE RJ1)

Alice identified the perceived advantage that her 'special position' will give her when training to be a qualified teacher.

> I am able to relate with pupils that find that mathematics comes to them easy and students who find that mathematics not so easy. As well as with pupils who struggle with mathematics... I will know how to break down complex topics and explain [them] to students in a way they will understand. (Alice, PGCE RJ1)

Table 15 provides an overview of the participants' identities whilst on the SKE course.

Table 15: Identities on the SKE course

	Alice	Andrew	Christine	Deborah
Identities on the SKE course	A student of mathematics	A mathematics trainee; A mathematics student	A subject learner; A learner of subject knowledge	A student; A mathematics learner

The participants referred to their identity whilst on the SKE course as *a learner, a student or a trainee*, but in particular of the subject of mathematics. The term *a learner* can be defined as one who is learning a subject or skill, whilst the term *a student* suggests that one is formally engaged in a programme of learning. In both of these cases, the learning is of the mathematical subject knowledge required for teaching. The term *a trainee* suggests training for a job or profession. In this case, the profession is teaching and the specialist subject is mathematics.

Deborah, who had studied an SKE course online, whilst working full-time, and had previously studied for a Master's degree whilst working full-time, refers to being *a*

student. For Deborah, having been in full-time employment for six years, she is acknowledging the return to being formally engaged in a programme of learning.

> I guess really I just felt like a student… but a more proactive student, because I really wanted to do it… and I was really keen to do it, and I was really keen to ask questions, and definitely in the learning phase. I didn't sort of see it as a *means to an end* which is quite interesting because I thought that I would feel like that. (Deborah, INT1)

By using the phrase *means to an end,* Deborah refers to completing an SKE course as being a pre-requisite for her to join the PGCE course.

Andrew, Christine and Alice participated in a face-to-face, full-time SKE course. Having recent prior experience of working in a school as a teacher, Alice describes her identity whilst participating in the SKE course as *a student*. Like Deborah, Alice acknowledges the return to being formally engaged in a programme of learning after having been employed as an unqualified teacher in a school.

> On the SKE course I did feel like I was just a student… even the way you dress coming to the SKE course, you dress casual and you know that showed my identity… because the SKE course was mainly to do with the actual mathematical knowledge… was more like you as a student, do you understand all of the mathematical concepts… during the SKE course I saw myself as a student… I didn't see myself as a teacher. (Alice, INT1)

Christine, who started an SKE course immediately after her undergraduate degree, refers to being *a subject learner* or *learner of subject knowledge.* Christine acknowledges that the focus is on learning subject knowledge for teaching.

> I think I was a learner… but… at that time my subject knowledge, I didn't have that much subject knowledge at that time… I was learning the subject. (Christine, INT1)

Andrew, who is a career changer, refers to being *a maths trainee* or *a maths student.* For Andrew, the focus is on training for a new profession as a teacher of mathematics.

> I suppose that I was just a trainee… a maths trainee… I suppose a little bit of a student as well. I would say maths student because you are focusing on one specific subject and getting better at that subject. (Andrew, INT1)

Christine and Andrew note the difference between being *a student,* or *a learner,* on an SKE course and being *an undergraduate student*. Christine refers to her undergraduate studies as 'we were all just like normal students' (Christine, INT1) and Andrew saw himself on the SKE course 'not so much as a student because I see that as an undergrad because that's the going out… leaving everything until the last minute' (Andrew, INT1).

The Post Graduate Certificate in Education (PGCE) course

Table 16 provides an overview of the participants' professional identities whilst on the PGCE course.

Table 16: Identities on the PGCE course

	Alice	Andrew	Christine	Deborah
Identities on the PGCE course	A trainee teacher A professional Training to be a mathematics teacher	A trainee teacher	A trainee teacher A professional A learner	A trainee teacher
Identifies as a 'mathematician'	No	No	No	No
Identifies as a 'mathematics specialist'	No	No	No	No
Identifies as a 'subject switcher'	Yes	Yes	No	Yes

During the PGCE course, all four participants referred to themselves as *trainee teachers*. This is not surprising as this is how the PGCE course tutors are most likely to refer to the collective group of participants on this course. However, Andrew, Christine and Deborah stated specifically that they were *trainee teachers,* rather than *students*. As Christine explained, 'you're not students any more…

whereas when I did this degree we were all just like normal undergraduate students' (Christine, INT1). Andrew describes the difference as, 'doing this now as a PGCE… you are focusing on becoming a teacher but… it's everything that's why it's more of a trainee than a student' (Andrew, INT1). Deborah's response was similar to that of Andrew and Christine, but she also identified the potential difference in perspectives of those who may have started their initial teacher education immediately after their undergraduate studies.

> It's a very different experience to being a student and I see that not all of the people have made that mental leap. Some of the guys have gone from school, to degree, from degree to PGCE. They don't… they haven't… they still treat it like a student… whereas I don't… I don't feel like a student. I feel like a trainee teacher. (Deborah, INT1)

Deborah describes being on the PGCE course as 'similar to my departmental manager training' (Deborah, INT1). She highlights the difference in her identity on the PGCE course, as a mature career changer, compared to her perception of those who have started PGCE immediately after their undergraduate studies who may still 'treat it like a student' (Deborah, INT1).

Christine refers to being a learner, but also highlights the differences between being a learner on the SKE course and a learner on the PGCE course.

> I'm a learner in a way. I was learning the subject here [points to SKE on ACT2], but here [points to PGCE on ACT2], I'm learning now how to deal with students, or how to, I mean teach. (Christine, INT1)

All four participants recognised a shift in their identity, from being on the SKE course, to being on the PGCE course, as illustrated by Alice's reflections:

> I think there has been a shift… I feel more like a professional now as a PGCE student... when you go into school even if you are just observing you just feel that you are more formal, you are more professional… more like how you conduct yourself in school… the focus is on your professionalism as a

> teacher whereas the SKE course was more like you as a student... so it's quite a shift… in identities as well. (Alice, INT1)

Alice and Christine, who were both recent graduates, referred to being *a professional* on the PGCE course.

> Now… in doing this course, when we came here on the first day, you're not students now, you are entering the profession… it feels proud... like this teaching career is really good, like you all are teachers now. You are learning to be a teacher. (Christine, INT1)

The two career changers, Andrew and Deborah, have extensive vocational experience and indicate that they are not scared to give things a go, even if they don't get it right first time. For example, Deborah acknowledges how she feels on the PGCE course as a recent learner of mathematics on the SKE course.

> When you learn as an adult you kind of become more accepting of not knowing things. Because I relearned stuff in the last… year and a half, I'm not bothered about asking questions, or if I've got something wrong then I accept it a little bit easier. (Deborah, INT1)

Deborah perceives that this may not be the case for those who have a mathematics degree and so have not completed an SKE course.

> Whereas some of the guys who've done a maths degree, if they've got it wrong they don't like it, or they kind of go, oh I don't want to teach it like that, or I don't like that explanation, or whatever. (Deborah, INT1)

Andrew refers to being a mature participant on the PGCE course and his perception of being different to his peers.

> Well I know I'm the oldest, well in maths anyway, I'm the oldest. It makes me feel old when I say I graduated university… and they… hadn't even started school. I feel old... I think I'm the awkward one. (Andrew, INT1)

Having extensive career experience, Andrew states, 'just chuck me in at the deep end' (Andrew, INT1).

> I'm like, just let me, just chuck me in just let me go. If I fall flat on my face, I fall flat on my face. I'll pick myself up, dust myself off. Tell me where I've gone wrong and I'll do it better. I think that's a better way of doing things. (Andrew, INT1)

Andrew was eager to start teaching, rather than continue observing other teachers. He expresses concern about 'losing' part of himself, as he observes the practice of other teachers.

> Especially because if you've got ideas yourself of what you want to do and how you want to teach and you sit and watch the same teachers over and over again you are going to start picking up all of their things, and maybe lose some of your own things, which would in effect you'd be losing part of your teacher identity and picking up somebody else's, or copying it. (Andrew, INT1)

Alice's experience of working as an unqualified teacher provided her with experience of the school environment. Alice considered her lived experience as a teacher to be an advantage in training to be a qualified teacher on the PGCE course.

> When you start off as a teacher, there are a lot of mistakes that you make. I feel that I will avoid a lot of those mistakes because I've seen it before and I know, okay I've done this and it didn't work, don't do that again. Or I did this, it was worthwhile, let me do that again. (Alice, INT1)

In particular, she considered that her experience gave her an advantage, over her peers on the PGCE course, who did not have teaching experience.

> When we are in our seminars, all of the questions that other people ask, I… already know the answer to it because I have experience of it. A lot of them are so worried… what's going to happen when I stand in front of a classroom? What if a student asks me a question that I don't know? I already know the response to it, so I think that has given me a massive advantage others don't have. I know… the school system… I know the school structure, I know how it works. (Alice, INT1)

Despite the advantages of Alice's experience, she also found there were disadvantages in her experience of teaching as an unqualified teacher in a challenging school.

> Because I've observed the lessons, and been around… that environment, I feel that I've picked up a few bad habits… so I think that is what is hindering me. I have to unlearn those bad habits… especially behaviour management. (Alice, INT1)

Andrew, Christine and Deborah, who have not worked previously as teachers in school, did not identify as teachers early in their PGCE course. Christine's reply indicated that she did not expect to feel like a teacher until she was on school placement: 'Teacher? I don't know until I… go there, to the schools, and… speak to the students and be with them: you can't really tell' (Christine, INT1).

Alice described her identity whilst on the PGCE course as *a trainee teacher* but, in drawing on her prior experience of teaching, also *a teacher.*

> Currently I feel like I am *a trainee teacher*… I also feel like a teacher in a way because I've had that experience. I kind of still feel like a teacher but training to be a maths teacher. (Alice, INT1)

Alice also refers to the differences in her identity as *a teacher,* from working as an unqualified teacher to being on an initial teacher education course.

> I viewed myself as a teacher but… it's completely different, it's really different to now. There is a big difference between then and now because I was sort of drawn into the deep, not really having any training whatsoever… whereas now I kind of know the difference. (Alice, INT1)

Alice considers her identity as *a teacher* on an initial teacher education course to have been influenced by her prior experience of having worked as an unqualified teacher.

> I think I do still feel like I'm a teacher and I feel like when I'm in the classroom… I think even the kids, the way they relate to me… they perceive me… to be a teacher because the way I… handle myself around the classroom… [they] can tell that I've been there before, and that I've had the experience with it, and so I see myself as a teacher but maybe a trainee maths teacher. (Alice, INT1)

Alice and Deborah raise the issue of not having a degree in mathematics. Alice considers one of her greatest challenges in training to be a mathematics teacher is that she has 'not done a mathematics degree' unlike many of the students on the PGCE course (Alice, PGCE RJ1). Deborah also comments on being *a non-mathematician* in a cohort of mathematics graduates, 'there are a lot of maths graduates… so that kind of shook my confidence a bit' (Deborah, INT1).

Despite their fondness for mathematics at school, and their current desire to become teachers of mathematics, none of the four participants fully identified with being *a mathematician,* although there was some evidence of uncertainty in the responses: 'Yes and no' (Alice), 'Not really' (Alice and Andrew), and 'Probably not' (Deborah). Christine replied that she is not a 'proper mathematician yet' and does not equate being 'a mathematics teacher' with being 'a proper mathematician', although one of her future-orientated aspirations is 'to become a proper mathematician' (Christine, INT1).

Whilst none of the participants committed to viewing themselves to be *a mathematics specialist*, Alice and Deborah were all a little more open to this term compared with the term *a mathematician*. Alice indicated, 'I think I'm getting there' (Alice, INT1) and Deborah suggested that 'if you ask me in two years' time, I think I probably will feel like that' (Deborah, INT1).

This uncertainty arises as the participants are aware that they do not have a mathematics degree and hence do not identify as a mathematician or a mathematics specialist. Andrew and Deborah, who are both career changers, felt that they could not refer to themselves as *a mathematics specialist* or *a mathematician* as it would undermine the achievements of those who are graduates of mathematics. Andrew

explained that he is ‘not a mathematician or specialist, like some of the people I hear about who’ve done a maths degree and things like that’ (Andrew, INT1). Similarly, Deborah states:

> I would feel uncomfortable… they all did degrees in maths… I would say there is a divide… I feel like I’d be taking something away from them to describe myself as a mathematician (Deborah, INT1).

Alice recognises that she is ‘going to have to switch and start thinking differently, thinking mathematically’ (Alice, INT). When asked if they considered themselves to be subject switchers, three participants indicate that they do view themselves in this way. Alice, Andrew and Deborah note that, despite their alternative subject specialisms from their degree studies, their ‘interest is so heavily in maths, especially currently’ (Deborah, INT1). The shift in subject focus is recognised particularly in Alice’s response.

> Definitely… there is maths in Psychology but it’s so completely different… maths has a whole different language to it, a whole different way of thinking. It’s completely different, very different. (Alice, INT1)

Deborah, who has an undergraduate degree and a Master’s degree in Politics, acknowledges that in shifting subject towards mathematics she is potentially leaving behind some of her previous specialist subject identity ‘I suppose so, which is a real shame because I really enjoyed what I did’ (Deborah, INT1).

One participant, Christine, does not identify as being a subject switcher.

> No, I wouldn’t say that. It was because of some circumstances that I had to change my course, change my subject, but I always wanted to do this. (Christine, INT1)

Due to having to follow an alternative study path to her first choice, of mathematics, Christine does not consider herself to be switching subject. Despite not considering herself to be a subject switcher, Christine does not yet identify with being *a*

mathematician, or *a mathematics specialist,* and has identified the need to continue to improve her subject knowledge, 'to become a proper mathematician' (Christine, INT1).

4.4.3 Future-orientated identities

Sfard and Prusak (2005) discuss designated identity as consisting of 'narratives presenting a state of affairs which, for one reason or another, is expected to be the case, if not now, then in the future' (p. 18). Lutovac and Kaasila (2014) considered future identities in a similar way (p. 132), applying the notions of possible selves (Markus and Nurius, 1986). The term, 'future-orientated identities', in this study focuses on the participants' narratives in terms of their aspirations for their future as qualified teachers of mathematics. These are summarised in Table 17.

Table 17: Future-orientated identities

	Alice	Andrew	Christine	Deborah
Future-orientated identities	A qualified teacher; A qualified mathematics teacher	A good teacher; The best teacher I can possibly be	A mathematics teacher with good subject knowledge; A proper mathematician	School leadership
Future-orientated aspirations and identities draw upon:				
Own experience of schools and teachers	Yes	Yes	No	Yes
Prior subject specialism	Yes	No	No	Yes
Absence of mathematics degree	No	Yes	Yes	No
Vocational experience	Yes (in teaching)	Yes (alternative career)	N/A	Yes (alternative career)

All four participants were on a course that leads to Qualified Teacher Status (QTS) with the intended future of a career as a qualified teacher of mathematics. The

future-orientated aspirations and identities of the participants whilst on the PGCE course are as varied as their individual experiences and draw on their differing personal and professional identities.

Christine always wanted to specialise in mathematics and the development of mathematical subject knowledge is key to her future-orientated identities. Christine aspires to be 'a maths teacher with good subject knowledge'. This future-orientated identity brings together Christine's identities of being 'a learner of subject knowledge' on the SKE and 'learning to be a teacher' on the PGCE. The subject itself is most important to Christine, who does not identify as being a subject switcher, as she always wanted to study mathematics. Christine's future-orientated aspiration is 'to become a proper mathematician' as 'even… if I be called a mathematics teacher, I don't think I will be a proper mathematician' (Christine, INT1).

Alice has prior experience of teaching mathematics as an unqualified teacher and considers her future-orientated identity to be specifically, *a qualified teacher,* and in particular, *a qualified mathematics teacher.* These future-orientated identities are a shift for Alice from her incoming vocational identity as a mathematics teacher who has not completed training.

Andrew has extensive alternative career experience, in the field of customer services, and draws on the transferrable skills that he developed in supporting and training colleagues. This, along with the absence of an identity as a mathematics specialist, leads Andrew to be first and foremost concerned with being 'a good teacher' rather than 'a good maths teacher' (Andrew, INT1).

Deborah's future-orientated aspirations are in school leadership: 'I would like to develop into a head of subject and potentially one day… an assistant head teacher'

(Deborah, PGCE RJ1). Deborah explains that in the 'long term I would like to be in senior management in schools and I think that marries the two things together [points to prior identities and current identities on ACT2] (Deborah, INT1). For Deborah, this brings together her incoming identity as a manager and her identity on the PGCE course as a trainee teacher.

Alice and Deborah's future-orientated aspirations draw on the subject specialisms of their undergraduate studies. Alice's future-orientated aspiration is 'to go into social care because that comes from the Psychology aspect' (Alice, INT1). Deborah still holds a potential place for her subject specialism of Politics in her future teaching career stating 'if I could draw up an ideal job I'd love to be able to teach maths, and maybe do Politics with the A-level in the school, because that would be ideal' (Deborah, INT1).

Whilst Andrew does not draw on his subject specialisms of Business Management and Information Technology when talking about his future-orientated aspirations, he does draw on another subject that he enjoyed at school.

> The only other subject I looked at possibly doing was history… I really enjoy history as well… so it's something that I might look at doing, further down the line possibly… if they turn round and say, can anybody cover history? (Andrew, INT1)

Although Christine's future-orientated aspirations do not draw explicitly on her Business Management degree, they do draw on her absence of a mathematics degree, or more specifically her absence of an identity as a mathematician or mathematics specialist. Christine indicates a desire to continue to enhance her subject knowledge for teaching.

> At the moment I am only focussing on teaching GCSE because my knowledge is only… I could only be very confident to teach GCSE, not A-

> level. So I might in future… go back to learning or… doing [a] maths degree, or wherever, I can teach higher stuff. That's what I would like to do. (Christine, INT1)

Despite the varying future-orientated aspirations and identities, having all experienced challenges in the progression of their mathematics studies at post-16, all four participants refer to wanting to make a difference for learners of mathematics. As Alice explained:

> That is why I decided to become a mathematics teacher, so that I could help break the negative stereotype of mathematics, I want to help make mathematics fun and accessible to all. (Alice, PGCE RJ1)

Similarly, Andrew draws on his own experience of school mathematics when describing the type of teacher that he wants to be.

> I want to be the kind of teacher that can spot people's skills and weaknesses and obviously get them to overcome their weaknesses but make sure that they are not just working to their level. I want to be the sort of teacher that pushes everyone that's capable past where they should be, to get the most… because that's what I didn't have at school and that's what I think everyone should get. (Andrew, INT1)

Deborah draws on her own background, and her desire for social justice, when expressing her future-orientated aspirations.

> I have always been keen to make a difference and give everyone a fair chance in life… I believe that as a maths teacher I could really make a difference and support my students… inspire a passion and interest in maths. (Deborah, PERS)

Having experience of working as an unqualified teacher, Alice comments; 'I feel like my identity is going to change when I actually become a teacher' (Alice, INT1).

4.5 Conclusion to the chapter

This chapter has presented individual participant stories, constructed from a range of narrative data and based on the participant voices of their lived experience. Themes arising from the participant stories have been presented in terms of prior experience and the journey to becoming a qualified teacher of mathematics.

The prior experience of the participants was captured as crucial contextual information to inform the research sub-questions. By examining participant narratives of their lived experiences, and future aspirations, one can begin to identify incoming, transitioning, and future-orientated identities. The participant stories outline how their lived experiences, and hence incoming identities, have influenced their journey to becoming qualified teachers of mathematics.

The following chapter presents an interpretation of these research findings, using a framework for analysis based on Wenger's (1998) trajectories within the theoretical framework of learning and identity construction within communities of practice (Lave and Wenger, 1991; Wenger, 1998).

Chapter 5: Discussion of Findings

5.1 Introduction to the chapter

This chapter provides an interpretation of the findings from the participants' narratives of their lived experience of becoming teachers of mathematics, using a framework developed from Wenger's (1998) notion of trajectories. The key for the data sources is as in Table 8 (section 4.1).

All of the beginning teachers in this study are graduates of non-mathematical disciplines and yet they all chose to train as secondary school teachers of mathematics. Due to the absence of a degree in a mathematical discipline, the participants all completed a 28-week mathematics subject knowledge enhancement (SKE) course prior to commencing a Postgraduate Certificate of Education (PGCE) course, leading to the award of qualified teacher status (QTS). Despite these commonalities, these 'subject switchers' (section 1.6) have greatly varied experiences in terms of their background, academic qualifications, subject specialism and vocational experience.

The overarching research question was: 'How does being a subject switcher influence the negotiation of identities as a teacher of mathematics?' The three research sub-questions (RSQs) captured essential contextual information for attempting to answer the overarching research question. The first research sub-question (RSQ1) was concerned with identifying the 'incoming identities' of the participants. The second research sub-question (RSQ2) was concerned with understanding the 'transitioning identities' of the participants during the SKE and PGCE courses. The third research sub-question (RSQ3) was concerned with considering 'future-orientated identities' as beginning teachers of mathematics.

Following an overview of the theoretical framework (section 5.2), and an overview of the trajectories of the participants (section 5.3), an interpretation of the findings from the participants' narratives will be structured under the following headings related to the research sub-questions (RSQs).

- RSQ1: Incoming identities (section 5.4)
    - Social identities
    - Subject identities
    - Career identities
- RSQ2: Transitioning identities (section 5.5)
    - The Subject Knowledge Enhancement (SKE) course
    - The Postgraduate Certificate in Education (PGCE) course
- RSQ3: Future-orientated identities (section 5.6)
    - Social identities
    - Subject identities
    - Career identities

These sections are followed by a conclusion to this chapter (section 5.7) which provides a response to the overarching research question.

5.2 Theoretical framework

The theoretical framework of learning and identity construction within communities of practice (Lave and Wenger, 1991; Wenger, 1998) was used to consider the transitioning identities of the participants of this study. A community of practice is defined by Lave and Wenger (1991) as 'a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice' (p. 98). The participants of this study have been members of social, academic and vocational communities of practice as well as those communities associated with their initial teacher education and designated future careers as teachers in secondary schools. A framework for analysis was developed based on Wenger's (1998) notion of trajectories.

Table 18: Wenger's trajectories in the context of the participants of this study

Type of trajectory	Description of Trajectory (Wenger, 1998, p. 154-155)	Wenger's trajectories in the context of the participants of this study
Outbound	Outbound trajectories lead out of a community and involve seeing the world and oneself in new ways.	Participants' prior and current engagement in academic, vocational and social communities will influence their engagement in new communities (i.e. SKE, PGCE and the teaching profession).
Peripheral	Peripheral trajectories provide access to a community and its practice that may contribute to one's identity, even though it may not lead to full participation.	Peripheral trajectories may include life experiences and membership of communities; including family groups, social groups and academic groups.
Inbound	Newcomers joining a community with the potential of becoming full participants in its practice in the future; present participation may be peripheral.	The participants have inbound trajectories to their initial teacher education courses and to the teaching profession.
Insider	Identity continues to evolve in response to continued experiences as full members of a community.	The participants have insider trajectories from their prior and existing academic, vocational and social communities of practice. They will become insiders in the SKE and PGCE communities and in the future they may have insider trajectories as qualified teachers in a school community of practice.
Boundary	Boundary trajectories link communities of practice and provide challenge to sustaining identities across communities.	Complex links will be made between participants' prior and existing membership of communities and their new inbound communities (i.e. SKE, PGCE and the teaching profession).

According to Wenger, identity is a learning process, a 'constant becoming' and 'something we constantly renegotiate during the course of our lives' (Wenger, 1998, p. 154). Individuals take multiple paths that lead to the formation of new identities, Wenger refers to these paths as 'trajectories' and describes identity as 'a trajectory in progress that includes where you have been and where you are going, your history and your aspirations' bringing 'the past and the future into the experience of the present' (Wenger, 2000, p. 241). Wenger (1998) identifies five types of trajectories: peripheral, inbound, insider, boundary and outbound (pp. 154-155).

These trajectories lead into and out of communities of practice. Individuals may belong to multiple communities and it is how they reconcile these multiple memberships that leads to developing identities. This process is ongoing as we move across boundaries from one community to another. An overview of Wenger's trajectories and an interpretation of each of these in the context of the participants of this study is provided in Table 18.

A framework for analysis was developed, based on Wenger's (1998) notion of trajectories and Grier and Johnston's (2012) conceptualisation of the career changers' pathway to teaching (section 3.7.2). This framework has been applied to the pathways taken by SKE course participants, with alternative subject specialisms, as they train to become teachers of mathematics. A diagram of the developed conceptualisation is shown in Figure 2.

5.3 The trajectories of the participants

The typical trajectories of the participants of this study were as follows. Participants joined the mathematics SKE course community of practice, as a condition of commencing their PGCE course, with the intention of becoming qualified teachers of mathematics (*inbound trajectories*). The participants had incoming identities from their life experiences, including experience of learning mathematics and alternative subject specialisms (*peripheral* or *insider trajectories*). These incoming identities (*outbound trajectories*) were drawn upon to negotiate new relationships (*boundary trajectories*) as the participants joined the SKE course community of practice (*peripheral and insider trajectories*). Following successful completion of the SKE course (*outbound trajectories*) the participants made the transition (*boundary trajectories*) to the PGCE course (*inbound trajectories*). During the PGCE course

(*insider trajectories*), participants engaged in school placements as student teachers (*peripheral trajectories*) which provided *boundary trajectories* for their first teaching positions as qualified teachers of mathematics (*inbound trajectories*). Of course, the journey does not end there as *insider trajectories* and identities will continue to evolve with continued experience and full membership in the school communities of practice.

The four transitioning participants in this study display all five of Wenger's (1998) trajectories with respect to their individual journeys towards possible futures as qualified teachers of mathematics. Table 19 summarises each participant's trajectories (using their pseudonyms), which are discussed throughout this chapter. These trajectories will be explored in the order of the lived experience of incoming, transitioning and future-orientated identities.

Table 19: The trajectories of the participants

Trajectory	Characteristics of identity	Alice	Andrew	Christine	Deborah
Outbound	Subject specialism	Yes – Psychology graduate	Yes – Business Management and Information Technology graduate	Yes – Business Management graduate	Yes – Politics graduate
	Time between degree and starting SKE	1 year	14 years	Immediately	6 years
	Alternative career	No – teaching (1 year)	Yes – customer services (14 years)	No – recent graduate	Yes – retail management (6 years)
	Prior teaching experience	Yes – unqualified teacher (1 year)	No	No	No
Peripheral	Prior experience of schools/teaching	Yes – taught in a school for one year	Yes – voluntary observations in school	Yes – voluntary observations in school	Yes – voluntary observations in school
	Prior experience of teaching/mentoring/training	Yes – tutoring	Yes – mentoring new colleagues	Yes - tutoring	Yes – training colleagues
	Prior work with children	Yes – Sunday school teaching/tutoring	Yes – Beaver Scouts	No	No
	Parenting	No	Yes – parent of two children	No	No
Inbound	SKE course	Yes	Yes	Yes	Yes
	PGCE course	Yes	Yes	Yes	Yes
	School placements	Yes	Yes	Yes	Yes
	Qualified teacher	Yes	Yes	Yes	Yes
Insider	Alternative career	No – teaching (1 year)	Yes – customer services (14 years)	No – recent graduate	Yes – retail management (6 years)
	Teaching in school	Yes – unqualified teacher (1 year)	No	No	No
	SKE course	Yes – 28 weeks	Yes – 28 weeks	Yes – 28 weeks	Yes – 28 weeks (online)
	PGCE course	Yes – 40 weeks	Yes – 40 weeks	Yes – 40 weeks	Yes – 40 weeks

Boundary	Draws on alternative subject specialism	Yes – draws on alternative subject specialism for future-orientated identities	No – but future-orientated identities draw on absence of a mathematics degree/specialism	No – but future-orientated identities draw on absence of a mathematics degree/specialism	Yes – strong feelings for alternative subject specialism but recognises that this may diminish due to increasing mathematical specialism
	Draws on own experiences of learning mathematics	Yes – draws on positive and negative experiences of learning mathematics at school/on SKE course	Yes – draws on positive and negative experiences of learning mathematics at school/on SKE course	Yes – draws on positive and negative experiences of learning mathematics at school/on SKE course	Yes – draws on positive and negative experiences of learning mathematics at school/on SKE course
	Draws on prior vocational experience	Yes – draws on positive and negative experiences as an unqualified teacher	Yes – draws on transferrable skills and experience of training colleagues in customer services sector	Not applicable	Yes – draws on transferrable skills and experience training colleagues in the retail sector
	Identifies as ‘a subject switcher’	Yes	Yes	No – as always wanted to study mathematics but was unable to	Yes
	Identifies as a ‘career changer’	No	Yes	No	Yes

5.4 Incoming identities

The term, 'incoming identities', (Friedrichsen et al., 2008) is used to refer to the existing identities of the participants when they commenced a SKE course in preparation for initial teacher education. The incoming identities of the participants are discussed under the following sub-headings: social identities (section 5.4.1), subject identities (section 5.4.2) and career identities (section 5.4.3).

5.4.1 Social identities

The participants called upon their social identities when talking about their own school education and influences in becoming a teacher (*boundary trajectories*). Alice, Christine and Deborah all refer to their socio-economic background as significant to their own education and their journey to becoming a qualified teacher.

Alice refers to having been selected for grammar school for her sixth form studies, 'based on my intelligence and not background'. Alice describes herself as being of 'a lower socio-economic background' and comments that 'the majority of the pupils in this school are middle class and it took me some time to adjust to the different environment'. Alice also identifies the important role of the educational maintenance grant and student finance to enable 'someone who is not from a rich background to be able to study at a higher level without having to worry about financial constraints' (Alice, EDT).`

Christine states that 'when I first came to this country… no one was here to help me. My parents weren't that educated, so nobody was there to give me support or know which way to go'. Christine got married and notes the positive influence of her husband in advising her of 'various education paths' and supporting her to pursue a career in teaching. Christine referred to her own family background and 'financial

conditions' when describing her motivation for a career in teaching, stating that she wants 'to be in a profession [in] which I can set an example for my future generation' (Christine, INT1).

Deborah describes herself as having 'a challenging background' (Deborah, PGCE RJ1) and 'coming from a family of limited resources' (Deborah, PERS), who 'lived in a little council house and didn't have a family car until I was 14' (Deborah, EDT). She gives an example of the impact of her socio-economic background and the lack of transport as 'being unable to learn to swim, as there were no swimming pools within an affordable reach'. In considering her own educational timeline, 'the factor that most influenced my time in education was the investment in the school system including the education maintenance allowance, free school meals and maintenance grants' (Deborah, EDT).

As a parent, Andrew considers that becoming a teacher will 'help with my kids as well' (Andrew, INT1). Whilst Andrew states extrinsic motivations of 'finding a stable career to provide for my child' (Andrew, PGCE RJ1) he also has intrinsic and altruistic motivations for becoming a teacher.

> I can pass on my knowledge and experiences to young learners as my teachers did for me. I want to teach to not only better myself but to be able to enrich school children's lives and learning experience. (Andrew, PERS)

5.4.2 Subject identities

All of the participants had experience of being a learner of mathematics at school (*insider trajectories*) and whilst they had 'always enjoyed mathematics' (Christine, PERS) and state that it was one of their 'favourite subjects' (Deborah, PERS), all had experienced difficulties in their progression in the subject at post-16 (*peripheral trajectories*). All of the participants subsequently pursued degrees in non-

mathematical disciplines and, as such, had alternative subject specialisms (*insider* and *outbound trajectories*). The subject identities of the participants are discussed in more detail in the following sub-sections: identities as a learner of mathematics, and alternative subject identities.

Identities as a learner of mathematics

All of the beginning teachers in this study had prior experience of being a learner of mathematics at school up to at least age 16 or 17 (*insider* and *peripheral trajectories*). Hence they could all be referred to as *returners* to learning mathematics, rather than *novices*, although they were all 'newcomers' (Lave and Wenger, 1991) on their *inbound trajectories* as participants on an SKE course.

All of the participants stated that they had enjoyed mathematics and that it was one of their favourite subjects at school. However, they all experienced both positive and negative experiences of learning mathematics at school. Despite the negative experiences, the participants had not disconnected from the subject itself 'although it was not always taught in the most creative or often interactive way, I still enjoyed the mathematics itself more than the lessons' (Alice, PGCE RJ1). All participants were successful at GCSE mathematics and Alice and Deborah had been entered early, in year 10, for GCSE.

Whilst all of the participants initially opted to study mathematics at post-16, all faced some difficulties with progression of their studies in this subject. One participant was unable to access post-16 mathematics studies and was forced to take an alternative subject. The other three participants commenced post-16 studies in mathematics but did not complete the A-level, as originally intended. These experiences provided

access to the A-level mathematics content and community (*peripheral trajectory*), although it did not lead to full participation.

Clarke's (2011) study highlighted the relationship between mathematics enhancement course participants' own 'experiences of learning mathematics at school' and 'their constructions of what kind of mathematics teacher they wished to be' (p. 7). All four participants of this study experienced both positive and negative experiences of being a learner of mathematics at school and the participant stories (section 4.2) illustrated that these experiences had influenced both their decision to train to be a teacher of mathematics and the type of teacher that they articulated they would like to be in the future.

For example, Alice states that one of her main reasons for deciding to become a secondary school teacher was the impact of 'the teachers I had in secondary school' (Alice, PGCE RJ1). Both the positive and negative experiences of school teachers, and teaching, influenced Alice's decision to train to teach as a secondary school mathematics teacher. Alice refers to the positive influence of one of her secondary school teachers who 'through his sheer passion and enthusiasm for the subject... inspired me to want to teach' (Alice, PERS). Alice also explained that her negative experience with her teachers 'makes me want to become a teacher, because I don't want anybody else to experience that' (Alice, INT1) and 'I learned from these experiences that it is vital to develop good relationships with pupils and not negatively label them' (Alice, SKE RJ1). Alice explains that she 'decided to become a mathematics teacher so that I could help break the negative stereotype of mathematics' and 'to help make mathematics fun and accessible to all' (Alice, PGCE RJ1).

Andrew also refers to the positive influence of his own teachers as a 'big factor', in particular his 'first ever maths teacher at high school' who had 'the ability to make even the most mundane subject seem to be the most interesting' (Andrew, PGCE RJ1). 'Teachers like this are what have made me want to go into teaching, to be able to influence someone's school life so much that they remember you so long after leaving school would be something I would be immensely proud of' (Andrew, SKE RJ1). Andrew also refers to negative experiences of learning mathematics, 'I didn't have the best maths education because the teacher I had was very classical in his style… and I don't learn like that' (Andrew, INT1). Andrew considers his experience of having struggled with some aspects of maths will help him as a teacher: 'I want to be able to help people in the future if they struggle with this subject, to try and help them to grasp the concept, so they don't struggle the way I did' (Andrew, SKE RJ3).

The participants called upon what Lortie (1975) termed the 'apprenticeship of observation' they had undertaken in having had years of 'direct contact with classroom teachers' (p. 61), to describe the type of teacher they wanted to be. Although Lortie acknowledged that the students' learning about teaching was 'gained from a limited vantage point' that 'relied heavily on imagination' (p. 63), Clarke (2011) found that 'having spent thousands of hours as schoolchildren observing and evaluating teachers in action' (p. 6) helped beginning teachers to articulate the type of teacher they wanted, and did not want, to become. Grier and Johnston (2012) also found that beginning teachers' views of a subject, and views of teaching that subject, were 'influenced by their own schooling' (p. 38).

Whilst Clarke (2011, p. 6) found that the participants of his study were initially 'planning to teach as they had been taught at school', the participants of this study

expressed a desire not to teach as they had been taught at school, describing 'monotonous' mathematics lessons (Alice, PGCE RJ1) of a 'textbook orientated style' (Andrew, EDT) where they were taught methods rather than for understanding. The participants of this study expressed a desire to teach 'creatively' (Christine, INT1) and 'inspire a passion and interest in maths' (Deborah, PERS).

The difficulties in progression in post-16 mathematics provided a significant turning point for all of the participants in terms of their future studies and subject specialism. All of the participants pursued alternative subjects for their undergraduate studies.

Alternative subject identities

All of the beginning teachers in this study were graduates of non-mathematical disciplines. The subjects that the participants had graduated in were varied: Andrew and Christine had specialised in Business-related fields whilst Alice and Deborah had specialised in aspects of the social sciences (*insider trajectories*). Whilst all identified numerical or mathematically-related aspects of their undergraduate studies, they acknowledged that mathematics is not their subject specialism. Hence, all of the participants could be considered to be subject switchers and had both *insider trajectories* and *outbound trajectories* from the academic and social communities of the subject of their degree on their *inbound trajectories* to becoming teachers of mathematics. *Boundary trajectories* are evident as the participants negotiate transitioning identities from their alternative subject specialism to becoming a teacher of mathematics.

For example, Alice describes herself as 'not having a mathematical background' (Alice, PGCE RJ1) and acknowledges that she had 'gaps in mathematical knowledge' (Alice, SKE RJ3) and that she 'needed an SKE course' (Alice, INT1).

However, she identifies mathematical content in her Psychology degree and considers that she 'developed great statistical knowledge for teaching maths' (Alice, PERS). Andrew also considers himself as not being a mathematics specialist but notes the mathematics content of his undergraduate studies ─ 'Business had sides of maths, it had finance and economics in it… I did marketing as well which obviously had a lot of statistics' (Andrew, INT1).

The time between the participants graduating in their subject specialism and starting an SKE course varied from immediately to fourteen years. Alice and Christine were recent graduates with only one year, or less, between completing their undergraduate degree and commencing an SKE course. Andrew and Deborah had graduated fourteen years and six years respectively prior to commencing an SKE course. Whilst it could be argued that *outbound trajectories* could be more pertinent for the recent graduates than for those with a substantial gap between graduating and starting an SKE course, there is no evidence in the participants' narratives to indicate that this is the case. For example, Deborah had a gap of six years between her specialist subject studies and commencing an SKE course and had not drawn on the content of her degree for her career in retail management. However she displayed a strong subject identity and loyalty to her subject specialism of Politics (*insider trajectory*). Deborah comments on shifting her subject focus to mathematics that it 'is a real shame because I really enjoyed what I did' (Deborah, INT1), whereas Christine, who started an SKE course immediately after her undergraduate studies, displays the least strong subject identity and loyalty to the subject of her degree, explaining that she studied Business because she couldn't 'do maths' but that she had 'always wanted to do maths' (Christine, INT1).

Regardless of their feelings towards the subject specialism of their degrees, all four participants have *insider trajectories* in subject disciplines and subject communities, other than in mathematics, although, for some, more time has passed since they left those academic communities of practice. The participants' *outbound trajectories* lead out of prior subject communities and involve 'seeing the world and oneself in new ways' (Wenger, 1998, p. 155), which influences their *inbound trajectories* as newcomers to initial teacher education (*boundary trajectories*).

The research into subject enhancement courses has focused on either evaluating the success of these courses (Gibson et al., 2013) or on the nature of subject knowledge for teaching (Adler et al., 2014). The implications of having an alternative subject identity have been little attended to in the literature. Hossain, Mendick and Adler (2013) however recognised that mathematics enhancement courses have been 'opening up' mathematics teaching to a greater diversity of people, in particular with a range of different qualifications and backgrounds (p. 46) and argue that we should explore the 'identity work' of subject enhancement course participants as they 'position themselves as future mathematics teachers' (p. 35).

5.4.3 Career identities

Alice, Andrew and Deborah had prior career experience, whilst Christine commenced an SKE course immediately after completing her undergraduate degree. All four participants spent some time in secondary schools in preparation for commencing their initial teacher education (*peripheral trajectories*). Alice had worked in a school for one year (*insider trajectory*) as an unqualified teacher of mathematics (*peripheral trajectories*) and had existing teacher identities. Having had careers in alternative sectors, Andrew and Deborah identified as *career changers*

and had strong career identities from their respective roles (*insider trajectories*). The career identities of the participants are discussed in more detail in the following sub-sections: teacher identities and alternative career identities.

Teacher identities

Alice was employed in a secondary school for one year, as an unqualified mathematics teacher, prior to commencing an SKE course. Alice describes her identity whilst working at the school as *a teacher,* but in particular, *an unqualified teacher.* She comments, 'that was my job title first' (Alice, INT1), referring to the post she had been employed in and how she was recognised in the school community.

Alice's experience of working as an unqualified teacher provided her with insider experience of the school environment. Alice viewed her lived experience as a teacher as an advantage in training to be a teacher on the PGCE course: 'when you start off as a teacher there are a lot of mistakes that you make, I feel that I will avoid a lot of those mistakes because I've seen it before' (Alice, INT1). In particular, she considered that her experience gave her a 'massive advantage' over her peers on the PGCE course, who did not have teaching experience: 'all of the questions that other people ask, I already know the answer to it because I've had experience of it' (Alice, INT1). Alice states, 'I know the school system, I know the school structure, I know how it works' (Alice, INT1). Despite the advantages of Alice's experience, she also considers that there are disadvantages in having prior experience as an insider in a school's community of practice: 'I feel that I've picked up a few bad habits, so I think that is what is hindering me. I have to unlearn those bad habits' (Alice, INT1).

Alice's experience provided her with an *insider trajectory* to the teaching profession, albeit as an unqualified teacher. Alice had an *insider trajectory* from the time spent

working in a school as a teacher as well as an *outbound trajectory* from leaving that particular school community to start an SKE course and commence her journey to becoming a qualified teacher (*inbound trajectories*).

Whilst Andrew, Christine and Deborah had not worked in a school previously, they had all spent some time voluntarily observing and supporting in secondary school classrooms which provided them with *peripheral trajectories* to becoming a teacher. This experience allowed these prospective teachers to interact with the school community and classroom environment prior to making a commitment to potentially becoming full members of the community in the future. For example, this experience helped Christine to confirm that 'I want to go and pursue this career' (Christine, INT1). By commencing *inbound trajectories* to initial teacher education, via an SKE course, these participants were opening up to 'possible futures' as secondary school teachers of mathematics (Wenger 2000, p. 241).

All four participants had some experience of working with children, or young adults, prior to commencing their initial teacher education (*peripheral trajectories*). Alice and Christine had tutored young people and, as found by Friedrichsen et al. (2008), the incoming identity of 'tutor' supported the participants' teacher identity by providing 'a window into the world of teaching' allowing participants to 'experience the joys of teaching' and 'view themselves as teachers' (pp. 181-182). Andrew and Deborah had experience of training and mentoring young adults in the workplace which provided an insight into teaching and the personal satisfaction that can be gained from supporting the development and success of others.

Two of the four participants had previously worked voluntarily with children in social settings: Alice as a theology teacher and Andrew in supporting a Beaver Scouts'

group. These experiences provided an insight into working with children and are cited as reasons why these participants considered teaching as a career. For example, through Andrew's experience of working with Beaver Scouts, he 'realised that I liked being around kids, they are funny, they are the most interesting people' (Andrew, INT1).

As well as having worked as an unqualified teacher of mathematics in a secondary school, Alice had worked with young people, aged 11-19 years, as a volunteer delivering theology lessons at a Sunday school. This experience showed her that she 'particularly enjoy[s] educating children' (Alice, PERS). Alice has also had experience of leading a youth dance group and providing voluntary tutoring in mathematics. Alice states that her 'numerous experiences in teaching have stimulated me to want to become a teacher' (Alice, PERS) and that she has 'stood in front of children and taught them, so I think it's just a natural progression from what I've done before' (Alice, INT1).

One of the four participants, Andrew, is a parent of two children which has provided him with further *peripheral trajectories* towards teaching and familiarity with schools. Friedrichsen et al. (2008) found that the incoming identity of 'parent' supported teacher identity.

The participants' prior experiences of working with children or young adults provided them with *peripheral trajectories* towards a career in teaching.

Alternative career identities

Andrew worked for fourteen years in a range of roles in the customer service sector and Deborah worked for six years as a department manager in the retail sector (*insider trajectories*). Andrew and Deborah both left their previous careers (*outbound*

trajectories) to train to become teachers of mathematics (*inbound trajectories*). Andrew and Deborah identify as career changers and have both *insider trajectories* and *outbound trajectories* from their previous careers. Leading out from a previous work community provides career changers with the ability to see themselves from different perspectives and begin the process of transitioning identity (Wenger 2000). Andrew and Deborah considered that they had 'previously developed career competencies' (Mayotte, 2003, p. 681) that were transferrable to teaching.

Andrew considers that the 'people skills' of 'empathy and patience' and 'the ability to communicate' that he developed during his time working in customer services are transferable skills that he can 'adapt' to working with young people that will be 'invaluable' for the classroom (Andrew, PGCE RJ1).

Grier and Johnston (2009) found that the career change participants in their study 'relied upon their identities from their previous careers' when entering teaching (p. 19). As with the participants in Grier and Johnston's (2009; 2012) studies, Andrew and Deborah called upon their identities from their previous careers whist training to be a teacher (*boundary trajectories*).

Deborah cited her experience of working with young adults as her motivation for coming into teaching: 'in my previous career, as a manager for a retailer, I worked with many young adults around ages of 16… and working with them and training them made me want to go into teaching' (Deborah, PGCE RJ1).

Andrew says, of his role as a technical support advisor, 'I was teaching people in a way, explaining how to use their phones' and that this 'combined with the people skills I learned will be invaluable when I move into the classroom' (Andrew, PGCE RJ1).

5.5 Transitioning identities

The beginning teachers in this study have *inbound trajectories* to becoming a qualified teacher of mathematics. The participants' transitioning identities, whilst on the SKE course and the PGCE course, will be explored in the following sub-sections.

5.5.1 The Subject Knowledge Enhancement (SKE) course

Alice, Andrew and Christine attended a full-time, 28-week, university-based SKE course and refer to themselves during this time as *a maths trainee*, *a maths student*, *a subject learner* or *a student of mathematics knowledge*. They all had *inbound trajectories* to the mathematics SKE course community and *outbound trajectories* from their prior subject and/or vocational communities of practice. Whilst on the SKE course, participants experienced *peripheral* and *insider trajectories* of working in a community focused on learning mathematics with the support of peers and university tutors.

Alternatively, Deborah studied an online SKE course part-time, whilst continuing full-time employment. The online subject knowledge enhancement course provided tutor support and also provided her with an *insider trajectory* as *a student* or a *maths learner*. She refers to herself during the SKE course as 'definitely in the learning phase' (Deborah, INT1).

By using the term, *a learner,* Christine and Deborah refer to learning the subject and skills of mathematics. By using the term, *a student,* Alice, Andrew and Deborah refer to the formal engagement of that learning i.e. they are formally enrolled on an SKE course that will lead to participation in initial teacher education. Andrew draws

further on the future-orientated membership of an initial teacher education community by using the term *a trainee*.

As in May et al.'s (2008) study, the participants valued the SKE course in acquiring mathematical knowledge and noted the valuable preparation this gave them for the PGCE course. The participants called upon their prior experience of learning mathematics at school to make links to learning mathematics on the SKE course (*boundary trajectories*). For example, Alice states:

> I think a lot of the learning in secondary school is learning to pass an exam, but not necessarily learning for understanding, so the SKE course helped me to understand more than just get the methods memorised. (Alice, INT1)

Alice notes that while 'returning to mathematics as an adult has at times been… hard', the SKE course 'has been very significant to my mathematical learning' and that she has 'seen great progress' and a 'massive improvement in my mathematical understanding' (Alice, SKE RJ3). Andrew refers to how his mathematics knowledge has 'grown dramatically' and his 'attitude towards teaching has altered a huge amount' since he started the SKE course (Andrew, SKE RJ4).

Clarke (2011), however, identified that changes in beliefs about the teaching of mathematics may not be turned 'into actions when they arrive in school' (p. 7). This could be the potential focus of further research into these participants as they commence their employment as qualified teachers of mathematics in schools.

5.5.2 The Post Graduate Certificate in Education (PGCE) course

The transition from the SKE course to the PGCE course provided each participant with *outbound trajectories* from the SKE course community and *inbound trajectories* to the PGCE course community. All of the participants experienced *boundary*

trajectories as they negotiated the linking of the two communities of practice and their prior and future identities (Wenger, 1998). This transition caused some tensions as the SKE participants joined a cohort of mathematics graduates on the PGCE course. On starting the PGCE course, Deborah commented 'there are a lot of maths graduates… so that kind of shook my confidence a bit' (Deborah, INT1).

As in Clarke's (2011) study, the participants 'did not see themselves as mathematics experts' and were concerned about their 'confidence in their own mathematical ability', even though they 'acknowledged that the mathematics enhancement course 'had helped them to build their mathematical knowledge' (p. 5). The participants did not generally identify as being *a mathematician* or *a mathematics specialist*. Typical responses were, 'I'm not a proper mathematician, yet' (Christine, INT1) or 'not a mathematician', like those 'who've done a maths degree' (Andrew, INT1). Deborah explains, 'I would feel uncomfortable… they all did degrees in maths… I would say there is a divide… I feel like I'd be taking something away from them to describe myself as a mathematician' (Deborah, INT1). As Wenger (2000) states, 'we define ourselves by what we are not as well as by what we are' (p. 239).

The lack of identity as *a mathematician* or *a mathematics specialist* stems from the participants having 'not done a maths degree' and not having 'a mathematical background' (Alice, PGCE RJ1), unlike the other students on the mathematics PGCE course. This is despite the mathematical knowledge and understanding they perceive themselves to have acquired from their SKE course. For example, Alice comments that the SKE course had given her 'more confidence in mathematics' and helped her 'become more of a mathematical thinker' (Alice, SKE RJ3).

Gibson et al.'s (2013) evaluation of SKE courses also found that although SKE courses equipped participants with subject knowledge and confidence in preparation for initial teacher education, the students considered their subject knowledge to be at a lower level than the traditional route trainees, who were subject graduates. Despite the participants in Gibson and colleagues' evaluation perceiving that the subject graduates have 'higher levels of knowledge' which would help them teach at higher levels, they also felt that this knowledge might be 'less relevant to the school context' (p. 11) and that they would be 'better equipped to break down the subject for students and to understand misconceptions and the difficulties pupils faced' (p. 13). Adler et al. (2009) also found that participants believed that they would have a 'leg up' as they had 'revisited school mathematics and learned it in depth' (p. 6). Crisan and Rodd (2011, p. 34) referred to the 'special insight' that those who have struggled with mathematics have, in understanding the difficulties faced by pupils.

The findings of Adler et al. (2009), Crisan and Rodd (2011), and Gibson et al. (2013) were echoed by the participants of this study. In particular, Alice considered herself to be in a 'special position' to support 'pupils who struggle with mathematics' as she will 'know how to break down complex topics and explain [them] to students in a way they will understand' (Alice, PGCE RJ1). Andrew considered that he could 'better teach these subjects, as I have a better understanding and appreciation of the difficulties that can be faced with these' (Andrew, SKE RJ3). Deborah also commented that 'having done my PGCE I feel so much more passionately about how mathematics is taught and how I suppose [I] got left behind' (Deborah, INT1).

During the PGCE course, all of the participants refer to themselves as being *a trainee teacher.* This is not surprising however as this is also how their PGCE course tutors are most likely to refer to them as a collective group. The participants

are undergoing education and training for a career in teaching and hence are *trainee teachers*. Christine also describes herself as *learning to be a teacher*, indicating an acquisition of pedagogic knowledge and skills. Alternatively, Alice describes herself as *training to be a maths teacher*, drawing on the process of initial teacher education (or training) and her *incoming identity* as *an unqualified teacher*. By using the terms *learning* and *training*, Christine and Alice, respectively, identify an action or process with the potential to result in a gain in knowledge or skill. In learning, or training, to become a teacher the participants acquire pedagogical knowledge for teaching secondary mathematics.

Andrew and Deborah are career changers and each has a significant gap, of more than five years, in time between completing their subject studies and starting an SKE course. They both refer to the differences between being an undergraduate student and being on the PGCE course, having had a career in between. Andrew refers to himself as 'not so much a student, because I see that as an undergrad, I'm a trainee teacher' (Andrew, INT1). Deborah explains, 'it's a very different experience to being a student, I don't feel like a student, I feel like a trainee teacher' whereas some 'have gone from school, to degree, from degree to PGCE, they still treat it like a student' (Deborah, INT1).

Alice and Christine, who have not had alternative careers, both refer to themselves as being *a professional* on the PGCE course and note the change in identity from being *a student* or *a learner* on the SKE course (*boundary trajectories*). Christine explains, 'you are not students now, you are entering the profession… you are learning to be a teacher' (Christine, INT1). Alice also states, 'I feel more like a professional now, as a PGCE student… the focus is on your professionalism as a teacher… so it's quite a shift in identities as well' (Alice, INT1).

5.6 Future-orientated identities

The term, 'future-orientated identities', (Lutovac and Kaasila, 2014) is used to refer to the participants' narratives of 'envisioning' their 'possible futures' (Wenger, 2000, p. 241) as qualified teachers of mathematics.

All four participants were on a PGCE course, with the designated future identity of a qualified teacher of mathematics (*inbound trajectories*). As the beginning teachers described their future-orientated aspirations and identities they called upon *outbound trajectories* from their subject specialism and career experience, *insider trajectories* from the SKE and PGCE courses, and *peripheral trajectories* from the PGCE school placements.

Wenger (2000, pp. 227-228) identifies engagement, imagination and alignment as three modes of belonging (Table 2). Despite the participants' *peripheral trajectories* as student teachers on school placement (engagement), describing their future-orientated identities as a teacher requires imagination to tell a story of potential futures and alignment of these aspirations with the school community of practice, of which they are not yet *an insider* but have *inbound trajectories*.

The future-orientated aspirations and identities of the participants, whilst on the PGCE course (*insider trajectory*), were varied and called upon their personal experiences (*outbound trajectories*) to different extents. These are explored under the sub-headings of social identities (section 5.6.1), subject identities (section 5.6.2) and career identities (section 5.6.3).

5.6.1 Social identities

All of the participants called upon their social identities when articulating their future-orientated identities (*boundary trajectories*). Alice, Christine and Deborah referred to their socio-economic backgrounds when describing the type of teacher they aspire to be.

Alice referred to both her family background and her experiences of her own teachers at school when describing the type of teacher that she wants to be: 'a mathematics teacher that genuinely cares about students, irrespective of their socio-economic background' (Alice, PGCE RJ1).

Drawing on her 'challenging background', Deborah comments, 'I have achieved many of my dreams: I want my students to believe they are capable of anything they want, too' (Deborah, PGCE RJ1). On the type of teacher that she would like to be, Deborah states, 'I have always been keen to make a difference and give everyone a fair chance in life... I believe that as a maths teacher I could really make a difference and support my students… inspire a passion and interest in maths' (Deborah, PERS).

Christine also referred to her own family background and 'financial conditions' when describing her motivation for a career in teaching, stating that she wants 'to be in a profession [in] which I can set an example for my future generation' (Christine, INT1).

Andrew referred to his identity as a parent, stating that, 'I want to teach to not only better myself but to be able to enrich school children's lives and learning experience' (Andrew, PERS) and that becoming a teacher 'will help with my kids as well' (Andrew, INT1).

5.6.2 Subject identities

All of the participants had incoming identities as graduates of non-mathematical disciplines. Alice and Deborah made explicit links between their subject specialisms and their future-orientated identities (*boundary trajectories*). Alice considered that her subject specialism in Psychology would be an advantage as it had 'helped me to understand and be familiar with learning, mental and psychological disorders… vital when dealing with SEND students' (Alice, PERS). Alice's future-orientated aspiration was to be involved in the pastoral side of teaching 'because that comes from the Psychology aspect' (Alice, INT1). Deborah also expressed a desire to maintain close links with her subject specialism of Politics in her future teaching career, stating that her ideal job would be 'to teach maths and maybe Politics A-level' (Deborah, INT1). Alice and Deborah experienced *boundary trajectories* as they 'create[d] bridges across communities' (Wenger, 2000, p. 239) and attempted to sustain identities across these communities.

Andrew and Christine did not draw on their alternative subject specialisms when articulating the type of teacher that they aspired to be, however they did both draw on their absence of a degree, or specialism, in mathematics. Andrew said that his future-orientated identities are to be 'a good teacher' and that he aspires to be 'a teacher that specialises in maths rather than a maths teacher' (Andrew, INT1). Christine's future-orientated aspiration is to be 'a maths teacher with good subject knowledge' and to continue to develop mathematically with the future-orientated identity of becoming 'a proper mathematician' (Christine, INT1). Andrew and Christine experience *boundary trajectories* as they link their absence of *insider trajectories* in undergraduate-level mathematics communities of practice with their future-orientated identities.

Whilst none of the subject switchers committed to identifying as *a mathematics specialist,* or *a mathematician*, there were indications that they may come to view themselves as such in the future. Christine states that she is not 'a proper mathematician, yet' (Christine, INT1). Alice and Deborah were both more open to the term, *a mathematics specialist,* than the term, *a mathematician*. 'I think I'm getting there' (Alice, INT1) and 'if you ask me in two years' time, I think I probably will feel like that' (Deborah, INT1). This supports Gibson et al.'s (2013) findings that newly qualified teachers, who followed an SKE route, did come to see themselves as 'subject specialists' (p. 12).

In all cases, the participants make complex links and experience *boundary trajectories* in transitioning from their previous subject specialisms, or lack of specialism in mathematics, to their future-orientated identities as teachers of mathematics.

5.6.3 Career identities

As with the participants in Mayotte's (2003) study, Andrew and Deborah were career changers and relied on their previously developed 'career competencies' when retraining to be teachers of mathematics (*boundary trajectories*). Grier and Johnston (2009) also found that career changers 'relied upon skills developed in their previous career to navigate a new profession' (p. 57) and that the teacher identities of the career changers was based in part upon their prior career experiences.

Deborah's future-orientated aspiration is 'to develop into a head of subject and potentially one day to be an assistant head teacher' (Deborah, PGCE RJ1). Deborah explains how her future-orientated aspirations bring together her incoming identity as a manager and her current identity as a trainee teacher. 'I enjoyed

leading and managing people and pushing people's personal development… long term I would like to be in senior management in school… and I think that marries the two things together' [points to prior identities and current identities on ACT2] (Deborah, INT1).

Mayotte (2003) found that 'seeing the connections' between learning and development in a previous career to 'what they do everyday within their classrooms' can support the career changer's 'adaptation to teaching' (p. 681). Mayotte also suggested that career changers should be supported in this transition by way of 'stepping stones' (p. 692).

As the participants qualify as teachers they assume *outbound trajectories* from the PGCE course and *inbound trajectories* as newly qualified teachers (NQTs). Their *insider trajectories* as teachers of secondary mathematics will continue to evolve as they gain further experience and competence in their chosen field (Wenger, 2000). *Boundary trajectories* will be important in navigating a successful transition from student teacher to qualified teacher.

On her future-orientated identity, Alice comments, 'I feel like my identity is going to change when I actually become a teacher' (Alice, INT1). A potential focus for future research is to follow these participants as they become NQTs and explore how their identities as *teachers of mathematics*, *mathematics specialists* and *mathematicians* develop as they gain further experience as *an insider* in the school communities in which they work.

5.7 Conclusion to the chapter

This chapter has presented an interpretation of the research findings, using a developed framework for analysis, based on Wenger's (1998) notion of trajectories (Figure 2). The participants of this study display all five of Wenger's trajectories: peripheral, inbound, insider, boundary and outbound (Table 19).

The participants had wide-ranging incoming identities and there is evidence in their narratives, that they experienced *boundary trajectories* as they called upon their incoming identities during the SKE and the PGCE courses. As in Friedrichsen et al.'s (2008) study, some incoming identities supported teacher identity and others caused tension.

All of the participants had prior positive and negative experiences of learning mathematics (*peripheral trajectories* and *insider trajectories*) and made links between learning mathematics at school and learning mathematics on the SKE course (*boundary trajectories*). The subject switchers' mathematical identities, in particular the absence of a mathematics degree, caused tension as they transitioned from having a specialism in an alternative subject to becoming a teacher of mathematics. They called upon either their alternative subject specialisms (*insider trajectories*), or their perceived absence of a mathematics specialism (*peripheral trajectories*), to make links to their learning of mathematics on the SKE course and to their future-orientated identities as teachers of mathematics (*boundary trajectories*).

Alternative career identities (*insider identities*) provided skills that were transferrable to teaching but also caused tension as participants transitioned from their previous career to teaching (*boundary trajectories*). The career changers called upon previously developed competencies (Mayotte, 2003) to make links to the skills

required for teaching and their future-orientated identities as teachers of mathematics (*boundary trajectories*). Prior experience of teaching-related activities (*insider trajectories*), such as tutoring and training, generally supported the development of a teacher identity (Friedrichsen, 2008). However, prior insider experiences of teaching in a school, whilst generally being supportive of a teacher identity, also created tensions. For example, having 'to unlearn bad habits' picked up from teaching as an unqualified teacher (Alice, INT1).

Social identities were called upon by participants as they made links between their personal experiences and becoming a teacher of mathematics (*boundary trajectories*). All participants referred to their social identities to describe the type of teacher that they would like to be and their future-orientated identities.

Whilst incoming identities can both 'support or hinder' the development of a teacher identity, viewed as 'critical in the process of becoming a teacher' (Friedrichsen et al., 2008, p. 175), the findings of this study suggest that teacher educators should strive to understand the incoming identities of beginning teachers and support them to make important links (boundary trajectories) to their emerging identities as teachers of mathematics. This is particularly relevant in the context of the increasing numbers of subject switchers entering initial teacher education.

The final chapter provides concluding reflections on the findings of this study, identifying the contribution to knowledge and recommendations for practice and future research.

Chapter 6: Conclusion

6.1 Introduction to the chapter

This final chapter provides concluding reflections on the findings of this study, responding to the research questions. The overarching aim of the study was to explore how being a subject switcher might influence the negotiation of identities as a teacher of mathematics by answering the following three research sub-questions:

1. What are the incoming identities of subject switchers embarking on a pre-initial teacher education subject enhancement course?
2. What identities do subject switchers negotiate during the subject enhancement course and initial teacher education?
3. What are the future-orientated identities of subject switchers as teachers of mathematics?

After responding to the research questions (section 6.2) and considering the limitations of this study (section 6.3), this chapter identifies recommendations for future practice (section 6.4), the opportunities for future research (section 6.5) and the original contribution to knowledge (section 6.6).

6.2 Findings for the research questions

6.2.1 Research sub-question 1: What are the incoming identities of subject switchers embarking on a pre-initial teacher education subject enhancement course?

The participants of this study had a wide-range of personal experience and hence varying incoming identities from the communities of practice to which they belonged. All had incoming social identities, subject identities and emerging teacher identities.

Social identities

The participants had incoming identities associated with dimensions of their social identity 'such as gender, race/ethnicity and class/socioeconomic status' (Darragh, 2016, p. 23). Those who had held social roles, such as being a parent, had incoming identities related to aspects of teaching.

Subject identities

As graduates of non-mathematical disciplines, the participants all had alternative subject specialisms from their degree studies. In addition, all participants had prior experience of being a learner of mathematics during their own schooling up until the age of 16 or 17. Hence, subject switchers have both incoming mathematical identities, from being a learner of mathematics at school, and alternative incoming subject identities from the subject discipline of their degree.

Teacher identities

All of the participants had prior experience of being a learner themselves at school and, in particular of being a learner of mathematics. Their 'apprenticeship of observation' (Lortie, 1975) experienced from their own schooling provided incoming teacher identities. Experience of teaching, or observing in the school classroom, also provided incoming teacher identities.

Those who had an alternative career prior to entering initial teacher education also had transferrable career competencies (Mayotte, 2003) and alternative incoming career identities. Likewise, experience of teaching or teaching related-activities, such as tutoring, mentoring or coaching, provided transferrable skills for teaching and incoming teacher identities.

6.2.2 Research sub-question 2: What identities do subject switchers negotiate during the subject enhancement course and initial teacher education?

As participants joined the SKE and the PGCE communities of practice, they called upon their incoming identities (boundary trajectories) as they linked communities of practice to sustain identity across communities (Wenger, 1998). As subject switchers on the journey to becoming teachers of mathematics, the participants of this study negotiated both mathematical identities and teacher identities.

Mathematical identities

All participants had experience of learning mathematics at school and hence can be considered to be returners to learning mathematics, rather than novices, although they were all newcomers to the SKE course. During the SKE course, participants negotiated mathematical identities as they linked their prior experience of learning mathematics at school and their new experiences of learning mathematics in preparation for teaching (Clarke, 2011).

The participants continued to negotiate mathematical identities as they joined the PGCE course. All acknowledged the tensions between their own mathematical identities and how they perceived themselves in comparison with others on the PGCE course, who had degrees in mathematics. None of the participants, at the time of this study, viewed themselves as mathematics specialists, although they all recognised that they may view themselves as such in the future. Typical responses were, 'I'm not a proper mathematician, yet' (Christine, INT1) or 'not a mathematician' like those 'who've done a maths degree' (Andrew, INT1).

Despite the subject switchers perceiving their subject knowledge to be at a lower level than those who were mathematics graduates, they considered themselves to be better placed to teach mathematics. The participants' responses echoed the

findings of Crisan and Rodd (2011) of being in a 'special position' to support 'pupils who struggle with mathematics' (Alice, PGCE, RJ1) and having 'a better understanding and appreciation of the difficulties' (Andrew, SKE RJ3).

Teacher identities

All participants had some existing teacher identities from the 'apprenticeship of observation' (Lortie, 1975) of their own schooling. Participants told stories of both positive and negative experiences of learning mathematics and they made links between these and what they learned on the PGCE course, as they negotiated identities as teachers of mathematics.

Social roles such as parent, tutor or mentor were generally supportive of teacher identity, although these sometimes caused tensions (Friedrichsen, 2008). One participant had experience of working as an unqualified teacher in a secondary school (insider trajectories) and had found this to be both an advantage and a disadvantage to her developing teacher identity.

> I think that it has given me a massive advantage… I know… the school system… I know the school structure, I know how it works… I feel that I've picked up a few bad habits… so I think that is what is hindering me. I have to unlearn those bad habits. (Alice, INT1)

6.2.3 Research sub-question 3: What are the future-orientated identities of subject switchers as teachers of mathematics?

The participants called upon their incoming identities when describing the type of teacher they would like to be and their future-orientated identities.

The participants referred to their social identities, including social background and roles held in communities of practice. In particular there was a sense of social justice and wanting to ensure that the mathematics learners of the future had a better experience than they had themselves as learners at school. Whilst the

participants' desire for social justice was a significant aspect of the findings, it was beyond the scope of this study to explore in more detail. This could however be an area of focus for future research.

Clarke (2011) found that the description of the type of teacher his participants wanted to be relied upon their combined experiences of learning mathematics at school and their experiences of learning mathematics on the subject enhancement course (boundary trajectories), however Clarke's (2009) earlier work also suggests that these aspirations might not be realised in practice. An area for future research would be to follow the participants of this study as they commence their teaching careers to see if their future-orientated aspirations are realised once they are teaching in school.

The participants also called upon their incoming subject identities when talking about their future-orientated identities. The majority of the participants made links between the subject discipline of their degrees and their future-orientated identities in an attempt to sustain incoming subject identities as they moved into teaching mathematics. One participant did not make these links and instead dismissed the subject of her degree, as she had 'always wanted to' study mathematics (Christine, INT1). However, Christine did not view herself as a mathematics specialist and her future orientated aspiration was to be 'a proper mathematician'. The absence of a mathematics degree was also significant for the participants as they considered their future-orientated identities.

The two career changers in this study made links between their previous careers and their future-orientated identities, so as to sustain 'previously developed career

competencies' (Mayotte, 2003) and skills in their new profession (boundary trajectories).

6.2.4 The overarching research question: How does being a subject switcher influence the negotiation of identities as a teacher of mathematics?

As graduates of non-mathematical disciplines, subject switchers negotiate both subject identities and teacher identities during their subject enhancement course and initial teacher education. The participants of this study called upon their incoming identities to make links to their new communities of practice during initial teacher education and when describing their future-orientated identities as teachers of mathematics.

Remnants of the participants' incoming identities were evident in their descriptions of the type of teacher they would like to be. Of significance, was the beginning teachers' prior experiences of being learners of mathematics; both positive and negative experiences were cited as examples of how the participants did (or did not) want to be as a teacher.

The absence of a mathematics degree was of particular significance in how the participants saw themselves as mathematics specialists. The subject switchers in this study did not consider themselves to be 'a proper mathematician' (Christine, INT1), like those 'who've done a maths degree' (Andrew, INT1). Gibson et al. (2013) found that SKE participants did eventually come to consider themselves as mathematics specialists. As Gibson and colleagues' evaluation was of different length SKE courses across the range of subjects, an area for future research would be to follow the participants of this study into their teaching careers to see if this is the case for those who have taken a long (28-week) SKE in mathematics.

Despite the subject switchers perceiving their subject knowledge to be at a lower level than those who were mathematics graduates, they considered themselves to have a 'special insight' (Crisan and Rodd, 2011) and to be better placed to teach mathematics.

Hossain, Mendick and Adler (2013) suggest that mathematics educators need to consider the 'various identities that people come in with and how this shapes what is possible for them' as well as giving 'attention to student-teachers' identity work during their courses and when they enter schools' (p. 46) to 'ensure that becoming a successful teacher is equally available to all' (p. 35). The findings of this study support this as a recommendation for future practice.

6.3 The limitations of the research

This interpretative study is limited to four cases from one institution, and as such, generalisations are not possible. Despite the limitations of the small number of participants, and the nature of the narrative data collected to compile individual participant stories, this study contributes knowledge to an identified gap in the literature on the identities of subject enhancement course participants in initial teacher education.

6.4 Recommendations for future practice

The findings of this study illuminate the importance of incoming identities in the development of teacher identities. Subject switchers negotiate both mathematical identities and teacher identities during their subject enhancement course and initial teacher education. Incoming mathematical identities and, in particular, the absence of a mathematics degree can cause tensions in how subject switchers come to see

themselves as mathematics specialists and hence in the negotiation of identities as teachers of mathematics.

It is important that teacher educators strive to understand the incoming identities of the beginning teachers with whom they work and that they support them with their identity work to make important links between their incoming identities and their identities as teachers of mathematics. This is of particular importance in the context of subject switchers who hold alternative incoming subject identities from the subject discipline of their degree as well as existing mathematical identities from learning mathematics at school and on the subject enhancement course.

This study recommends exploring initial teacher education strategies that are more inclusive of subject switchers to support the negotiation of mathematical identities for becoming a teacher of mathematics. The conceptual framework developed for exploring identities in this study (Figure 2) has the potential to support this work and so dissemination to the teacher education sector at national level is important in achieving this.

6.5 Future research opportunities

There are a number of opportunities for future research, arising from the findings of this study.

One way in which this research could be developed further would be to follow the participants of this study into their first employment as newly qualified teachers. The focus for future research arising from this study could be:

- To further explore the findings of this study, the work of Clarke (2011) and the outcomes of the SKE evaluation report from Gibson et al. (2013) by

asking: Do subject switchers come to see themselves as mathematics specialists?

- To further explore the findings of this study and the work of Clarke (2009; 2011) by asking: Are the future-orientated identities of subject switchers realised in practice?
- To extend this study by asking: How does being a subject switcher influence the career paths of teachers of mathematics?
- To extend this study by exploring the experience of subject switchers in other shortage subjects.
- To follow-up on the findings of this study and the work of Hossain, Mendick and Adler (2013) by exploring more inclusive initial teacher training strategies, to support the identity work of subject switchers becoming teachers of mathematics.

The conceptual framework developed in this study (Figure 2) and based on Wenger's (1998) notion of trajectories could be adapted to consider the trajectories of qualified teachers. In particular, this framework could be transferable to the trajectories of qualified teachers who are teaching 'out-of-field' (Ingersoll, 1999; Hobbs, 2013) as 'non-specialist teachers' (Crisan and Rodd, 2017) and who may participate in an in-service subject enhancement course, such as TSST (NCTL, 2016).

The developed conceptual framework also has the potential to be adapted to other transitions in teaching, for example, switching between teaching in different phases of education (i.e. from primary to secondary), or becoming a teacher educator. Likewise, the framework could be adapted to transitions in other careers or disciplines.

6.6 Original contribution to knowledge

The aim and purpose of any doctoral thesis is to make an original contribution to knowledge; this is achieved in this thesis in a number of ways.

First, this small-scale study contributes to the body of literature on teacher identity generically and, more specifically, within mathematics education. Although many others have researched teacher identity within mathematics education, no one else has published research on the experiences and perspectives of the participants of this particular study, at this particular institution. This in itself is a unique contribution to research.

The findings of this study support the findings of other small-scale studies into subject enhancement courses (May et al., 2008; Clarke, 2011; and Stevenson, 2013) that these courses are successful in widening participation in mathematics initial teacher education. By widening participation, subject enhancement courses have been 'opening up' mathematics initial teacher education to a range of non-traditional participants with a wide-range of incoming identities (Hossain, Mendick and Adler, 2013).

This study specifically contributes to the gap in the literature on the identities of subject enhancement course participants. In particular, in the absence of a term in the literature, the term 'subject switcher' (section 1.6) was introduced to represent those whose degree is in a discipline that is not directly related to the subject they are training to teach. In the context of this study, a subject switcher is a participant in mathematics initial teacher training whose degree is in a non-mathematical discipline.

Finally, this study also contributes an original conceptual framework (Figure 2), based on Wenger's (1998) notion of trajectories, within the theoretical framework of learning and identity construction in communities of practice (Lave and Wenger, 1991; Wenger, 1998). This framework has the potential to be used in the teacher

education sector to support identity work. The framework also has the potential to be adapted for future research to consider other transitions in teaching, or in other fields.

6.7 Final reflections on the research

The completion of this study is timely in the context of recent increased scrutiny by the Department for Education (DfE) into the funding, content and models of delivery of non-quality assured SKE courses. This is in addition to a renewed 'strong emphasis' on 'the importance of subject specific training' in the recently published ITT Core Content Framework (DfE, 2019, p. 6).

This study, whilst identifying the need for teacher educators to support subject switchers with their identity work, serves as a reminder of the significant positive impact of SKE courses on the supply of qualified teachers of mathematics in England.

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8. Appendices

Appendix 1: List of abbreviations and definitions

A-level	General Certificate of Education Advanced level *A-level is the commonly used name for the General Certificate of Education Advanced Level (GCE A-level). A-levels are subject-based academic qualifications, normally taken in three, or more, subjects by post-16 students in England, Wales and Northern Ireland. GCE A-level qualifications are usually taken by students aged 16-18, after two years of study.*
AS-level	Advanced Subsidiary level *AS-level is an independent qualification encompassing the first year of a GCE A-level qualification's content in England, Wales and Northern Ireland. AS-level qualifications are usually taken by students aged 16-18 in post-16 education.*
DfE	Department for Education *The DfE has been responsible for children's services and education, including early years, schools, higher and further education policy, apprenticeships and wider skills in England since 2010.*
DfES	Department for Education and Skills *The DfES was a United Kingdom government **department** for the **education** system (including higher **education** and adult learning) as well as children's services in England. It existed from 2001-2007.*
EAL	English as an Additional Language *The use or study of the English language by non-native speakers in an English-speaking environment.*
GCSE	General Certificate in Secondary Education *The GCSE is an academic qualification, generally taken in a number of subjects by pupils in secondary education in England, Wales and Northern Ireland.* *GCSE qualifications are usually taken by students aged 15–16, after two years of study.*
GNVQ	General National Vocational Qualification *A GNVQ is a certificate of vocational education in the United Kingdom. The last GNVQs were awarded in 2007*.
ITE	Initial teacher education *ITE programmes are designed to educate teachers pre-service and lead to recommendation for QTS.*
ITT	Initial teacher training *ITT programmes are designed to train teachers pre-service and lead to the recommendation for QTS.*
MaST	Mathematics Specialist Teacher (programme) *The MaST programme is designed for experienced and practising primary teachers wishing to further deepen their understanding of mathematics and mathematics teaching and learning.*
MDPT	Mathematics Development Programme for Teachers *The MDPT was a TDA-funded in-service programme for non-specialist teachers of mathematics. The MDPT was replaced by the TSST.*
MEC	Mathematics Enhancement Course *The MEC was a pre-ITT subject knowledge enhancement course in preparation for teaching secondary mathematics. The MEC was replaced by SKE courses.*
MKT	Mathematical Knowledge for Teaching
NCTL	National College for Teaching and Leadership

	The NCTL was responsible for teacher recruitment between 29 March 2013 to 31 March 2018. These functions are now the remit of the DfE.
NQT	Newly Qualified Teacher *An NQT is a teacher who has just attained Qualified Teacher Status (QTS) and is now undertaking an induction programme that enables them to be legally employed as a teacher in a maintained school.*
Ofsted	The Office for Standards in Education, Children's Services and Skills *Ofsted is a non-ministerial department of the UK government, reporting to Parliament. Ofsted is responsible for inspecting a range of educational institutions, including state schools and some independent schools.*
PGCE	Postgraduate Certificate in Education *The PGCE is a one- or two-year higher education course in England, Wales and Northern Ireland which provides training in order to allow graduates to become teachers within maintained schools.*
QTS	Qualified Teacher Status *QTS is required in England and Wales to work as a teacher of children in state schools under local authority control, and in special education schools.*
SATs	Standard Attainment Tests *Statutory assessments carried out in schools in England, colloquially known as standard attainment tests (SATs).*
SKE	Subject Knowledge Enhancement (course) *SKE courses are pre-ITT courses to enhance subject knowledge in preparation for teaching secondary shortage subjects.*
STEM	Science, Technology, Engineering and Mathematics *STEM is a term used to group together these academic disciplines.*
TA	Teaching Agency *TA was a body responsible for initial teacher training and the regulation of the teaching profession in England from 2012-2013.*
TDA	Training and Development Agency for Schools *TDA was a body responsible for the initial and in-service training of teachers and other school staff in England from 2005-2012. These functions are now the remit of the DfE.*
TSST	Teacher Subject Specialism Training *TSST is designed for non-specialist teachers who are teaching mathematics, core maths, physics or MFL (modern foreign languages), those who wish to offer these subjects as an additional subject, and those looking to return to teaching.*
TTA	Teacher Training Agency *TTA was a body responsible for the initial training of teachers in England from 1994-2005.*

Appendix 2: Ethical approval

UNIVERSITY OF WOLVERHAMPTON

Section 4

CONFIRMATION OF ETHICAL APPROVAL AND FEEDBACK ON SUBMISSION

TO BE COMPLETED AS INDICATED, BY MODULE LEADER, SUPERVISOR AND/OR HEAD OF ETHICS PANEL

CATEGORY A PROPOSALS:

I confirm that the proposal for research being made by the above student/member of staff is a category A proposal and that s/he may now continue with the proposed research activity:

For a student's proposal – Name of module leader or supervisor giving approval	
For a member of staff's proposal – name of Head of Ethics panel giving approval	[redacted]
Signed	[redacted]
Date	21st May 2018

Appendix 3: Participant information

Participant Information

Negotiating professional identities as a beginning teacher of mathematics

You are invited to take part in a research study on the professional identities of beginning teachers of mathematics in the Institute of Education of the U [redacted].

This study will explore the prior expertise that beginning teachers have and how this might influence the negotiation of professional identities. This study focuses in particular on trainee teachers who have prior professional and/or alternative subject expertise prior to training to become a teacher of mathematics.

The study is an attempt to explore:

a) the professional identities beginning teachers negotiate
b) how prior professional and subject expertise influences the beginning teacher's journey
c) the ways in which beginning teachers negotiate shifting professional identities

The data from this study will be used to identify themes relating to the influence of prior expertise in the negotiation of professional identities as a beginning teacher of mathematics.

This study comprises two phases. In phase 1 you are asked to participate in an activity to identify prior expertise and to construct an individual 'map' to Qualified Teacher Status (QTS). In phase 2 you are asked to take part in an individual interview discussion to explore trajectories and professional identities arising from the phase 1 activity.

Only the researcher will have access to the data which will be stored on an encrypted, password-protected university computer for the duration of the study, after which the data will be deleted.

All names will be anonymised. Identifying features and quotations from narrative will be anonymised as far as possible, although it will not be possible to anonymise the

identifying features key to this study i.e. professional and subject experience. All raw data will be treated as confidential to within the limits defined by law.

Before deciding on whether to take part, please take time to consider the following information. Your participation is entirely voluntary and you are entitled to withdraw at any time without giving reason.

What is the study about?

The study is an attempt to explore:

a) the professional identities beginning teachers negotiate
b) how prior professional and subject expertise influences the beginning teacher's journey
c) the ways in which beginning teachers negotiate shifting professional identities

The study consists of:

a) participation in an activity to identify prior expertise and to construct a personalised 'map' to Qualified Teacher Status (QTS)
b) individual interview discussions to explore trajectories and the negotiation of professional identities

The target group for this study are postgraduate trainee mathematics teachers in the Institute of Education.

Who has reviewed this study?

The FEHW Research Ethics Committee at the [redacted]

Who is being asked to take part?

Postgraduate trainee mathematics teachers in the Institute of Education

What will happen to me if I take part?

In phase 1 you are asked to participate in an activity to identify prior expertise and to construct an individual 'map' to Qualified Teacher Status (QTS). With your consent, the paper-based outcomes of the activity will be photographed by the researcher. Photographs may be used in the thesis but will be anonymised as far as possible.

In phase 2, you are asked to take part in a follow-up interview discussion to explore themes arising from the activity. With your consent, the interview discussions will be audio-recorded and the narrative later transcribed by the researcher. Quotations from the narrative may be used in the thesis but these will be anonymised as far as possible.

Participation in both phases is entirely voluntary and you are entitled to withdraw at any time without giving reason.

What will happen to the data and will my taking part be kept confidential?

Only the researcher will have access to the data which will be stored on an encrypted, password-protected university computer for the duration of the study, after which the data will be deleted.

The audio recordings of discussions will be used only for analysis. Photographs of the paper-based activities and quotations from the narrative may be used in the thesis but all names will be anonymised. Identifying features will be anonymised as far as possible although it will not be possible to anonymise the identifying features key to this study i.e. professional and subject experience. In all instances, confidentiality will be guaranteed within the limits of the law.

Thank you for reading this information sheet, I hope that you will agree to participate in the research. If you do, you will be given a copy of the information sheet and the signed consent form to keep.

If you wish to obtain further information about this study please contact

[redacted]

Appendix 4: Reflective journal prompts

Reflective journal prompts

SKE course

SKE RJ1: Reflect on your experiences of learning mathematics at school. Give examples of exemplary teaching and/or poor teaching. Describe the type of teacher you would like to be.

SKE RJ2: Reflect on your experiences of learning mathematics on the SKE course. What have your enjoyed and/or found challenging? What are your strengths and areas for development?

SKE RJ3: What has been the most significant aspect of your learning of mathematics, so far, on the SKE course? Explain one aspect which has surprised and/or enthused you and one aspect which has disappointed and/or demotivated you, then discuss in detail the one which has had the most impact.

SKE RJ4: Reflect on your learning and progress during the SKE Course. How has your attitude towards teaching mathematics developed?

PGCE course

PGCE RJ1:

1. Why do you want to become a teacher in the secondary age phase?
2. What brings you to choose your specialist subject?
3. What skills and personal attributes do you think you will bring?
4. What do you expect the greatest challenges to be in the coming year?
5. What type of teacher do you want to become and why?

PGCE RJ2: Reflect on your learning and progress during your first school placement. What have your enjoyed and/or found challenging? What are your strengths and areas for development?

PGCE RJ3: Reflect on your learning and progress during your second school placement. What have you enjoyed and/or found challenging? What are your strengths and areas for development as a newly qualified teacher?

Appendix 5: Semi-structured interview prompts

Interview prompts (flexible loosely defined framework)

1. Tell me about your prior identities

Tell me about your experience prior to starting your SKE/PGCE course (as relevant)

- in what ways did your prior experience influence positively (help) in your decision to train to teach secondary school mathematics?

- in what ways did your prior experience influence negatively (hinder) in your decision to train to teach secondary school mathematics?

2. Tell me about your current identities

Tell me about your current identities on the PGCE course. How would you describe yourself? Identity cards: Student?; Student Teacher?, Trainee teacher?, Beginning teacher?, Teacher?

- in what ways have your prior identities influenced positively (helped) in this transition?

- in what ways have your prior identities influenced negatively (hindered) in this transition?

3. Tell me about your future-orientated identities

Tell me about your future identities as a qualified teacher of mathematics. What type of teacher do you want to be?

- in what ways are your prior and/or current identities helping in negotiating new identities as a teacher of mathematics?

- in what ways are your prior and/or current identities hindering in negotiating new identities as a teacher of mathematics?

4. Are there any other factors that have influenced your journey towards qualified teacher status?

Appendix 6: Example of coding the narrative

Example of coding interview transcription by themes arising from the data

I: Okay. So when did you first think of going into teaching?

P: It's really strange literally a week before I started the two day's work experience I was like 'ah I think that I should become a teacher' and then a week after I got the two day work experience and I just loved it. But… I've been working as a school teacher – a Sunday school teacher so I stood in front of children and taught them so I think it's just a natural progression from what I've done before.

I: So your prior work with children influenced your decision to go into teaching?

P: Yeah and I loved it. Cos I think over the summer as well - I did… I worked at my Sister's company for a bit, sitting behind a desk, and I really realised that's not for me and I need to be in front of children. I need to be, you know, interacting. Yeah.

I: Yeah.

P: So I think in the back of my mind I always knew that I think I just want to become a teacher but I think that I just didn't know it was maths teaching.

I: So tell me why you chose to teach maths?

P: Well… at first I wanted to do psychology because – teach psychology – but then… I was like that's a lot of work sorry that sounds so bad [laughs]

I: [laughs]

P: 'Cos essays and stuff and I remember that when I was at school I loved maths and it literally was my favourite subject… yeah I just like how – 'cos in psychology there's not one straight answer and I… don't like that. I want to know what's the answer to the question… you know in maths like… you get a conclusion, you get a final answer. So I just like that about maths and I just like that it's applicable to every single day – most of the maths – at least the numeracy part of maths is applicable to every single day and you will need it in your life and I also like that maths is international like everywhere you go, everybody does maths and everybody knows about it so you can always communicate with maths and stuff so I thought I think that's what I'm going to do that's what I'm going to go for.

Comment [GF10]: PRIOR EXPERIENCE OF WORKING WITH CHILDREN: Sunday School Teacher

Comment [GF11]: POSITIVE INFLUENCE OF EXPERIENCE OF WORKING WITH CHILDREN. 'I stood in front of children and taught them so I think it's just a natural progression from what I've done before.

Comment [GF12]: Accountancy company

Comment [GF13]: DISILLUSION WITH OTHER WORK: work experience in an office. '…sitting behind a desk and I really realised that's not for me. I need to be interacting'

Comment [GF14]: INFLUENCE OF PRIOR EXPERIENCE: Desire to work with children

Comment [GF15]: 'Always wanted to become a teacher…..'…I just didn't know it was maths teaching'.

Comment [GF16]: A LOVE OF MATHS 'loved maths…favourite subject'

Appendix 7a: Participant Story Alice

Alice is a 25 year old female who was educated in the Netherlands until she moved to England at the age of 13. Alice has a Bachelor of Science degree in Psychology and participated in a 28-week university-based mathematics subject knowledge enhancement (SKE) course prior to commencing a PGCE course. Her highest formal mathematics qualification is GCSE level.

Alice undertook part-time waitress and bartender work while she was at university and has experience of working with children and young people as a voluntary theology teacher. Before commencing an SKE course, she worked in a secondary school for one year as an unqualified mathematics teacher. Alice has also worked part-time as a supply teacher and as a mathematics and English tutor.

Prior experience

School education

Having entered the school system in year 9, barely able to speak English, Alice refers to the positive support of one of her secondary school teachers.

> My English teacher helped me to learn the language and get a level 6 in my SATs… He believed in me, despite the language barrier, and continually challenged me to get the best out of me. (PERS)

Alice was considered to be an EAL (English as an Additional Language) pupil. She perceives that this 'label' impacted negatively on some teachers' perceptions of her academic abilities: 'The teacher saw me as an EAL pupil. Therefore according to

her… low ability student. This was despite me showing her that I could achieve higher' (SKE RJ1).

> I've had teachers who negatively labelled me… they *put me in a box*. Okay you are an EAL student… you are pupil premium... I don't think that you should aim so high… maybe this is the best grade you can get. I had that all the way through my secondary school experience. (INT1)

The phrase, 'put me in a box', indicates that Alice felt that these teachers had already determined her potential by what they knew of her background. Alice described her resilience to this.

> I'm a tough girl. I don't break easily… so they would say that, and I was like okay, I'm going to prove you wrong. I remember my Psychology teacher telling me that there was more chance of him getting a Ferrari than for me to get a good grade in Psychology… I've just come to this course, I've not sat any assignments yet, why would you make that assumption about me? And he said that there was more chance of him winning the lottery than me getting a good grade and he was… English is not your first language, I don't think that you will do that well… I think that could really break somebody down, but obviously I'm a really resilient person, so I did extremely well in Psychology and I proved him wrong. (INT1)

Alice recalls that 'when I was at school, I loved maths, and it literally was my favourite subject' (INT1), although she considered that 'it was not taught in the most creative or often interactive way' (PGCE RJ1). Alice describes having experienced many a 'monotonous' mathematics lesson and having 'enjoyed the mathematics itself more than the lesson' (PGCE RJ1).

Alice was entered for her GCSE mathematics, a year early, in year 10.

> So I came [to England] in year 9… towards year 10 it was just like… do your GCSE in January… forget about maths, so after January that was it. So in year 10 I did my maths… sat the paper, and then that was it. So it was really methods… okay you've got the exam coming up, this is what you need to learn, this is what you need to do. This is what you need to do, learn it. (INT1)

Alice was initially going to study mathematics at A-level, but after the first week 'decided against it' and 'just stopped it' (INT1).

> Because I was just taught the methods, and I didn't really understand it. Jumping from GCSE maths, to A-level maths, is a *big leap* and especially if you don't fully conceptually understand the mathematical processing, you really struggle. (INT1)

By using the phrase, 'big leap', Alice refers to the perceived gap between GCSE mathematics and A-level mathematics that many students experience when they commence their A-level mathematics studies. Alice attributes this gap to having been taught procedural 'methods', rather than 'for understanding' (INT1). Her early entry for GCSE mathematics also meant that she had a 'year, and a bit, where I didn't really do much maths' (INT1).

Alice refers to having got into grammar school for her sixth form studies 'based on my intelligence and not background'. Alice describes herself as being of 'a lower socio-economic background' and comments that 'the majority of the pupils in this school [were] middle class and it took me some time to adjust to the different environment' (EDT).

Alice also identifies the important role of the educational maintenance grant and student finance in enabling 'someone who is not from a rich background to be able to study at a higher level without having to worry about financial constraints' (EDT).

Subject specialism

Alice is a graduate of Psychology and her highest formal mathematics qualification is GCSE level. Alice participated in a university-based, 28-week subject knowledge enhancement (SKE) course in mathematics, prior to commencing her PGCE course.

Alice describes herself as ‘not having a mathematical background’ (PGCE RJ1) but considers that, through her Psychology degree, she ‘developed great statistical knowledge… for teaching maths’ (PERS). Although there was mathematical content in her Psychology degree, Alice acknowledges that she had ‘gaps in mathematical knowledge’ (SKE RJ3) and that she ‘needed an SKE course’ (INT1).

Vocational experience

Alice worked for one year as an unqualified mathematics teacher at ‘a very challenging secondary school’ (PERS) prior to starting the SKE course. The intention had been that Alice would commence a School Direct Salaried employment-based route to initial teacher training (ITT) at the school and take an SKE course alongside her training. Unfortunately the school was put into ‘special measures’ by Ofsted and the mathematics department was no longer able to adequately support a trainee teacher. As Alice had already commenced her employment at the school at this time she decided to continue for the year as an unqualified teacher. She refers to this as being ‘*drawn into the deep* not really having any training whatsoever’ (INT1).

By using the phrase, ‘drawn into the deep’, Alice acknowledges that in working as an unqualified teacher she had not undertaken training for the role. The similar well-known phrase, ‘thrown in at the deep end’, suggests that someone has put you in that situation i.e. they have thrown you in. Alternatively the phrase ‘jump in at that deep end’ suggests that you have put yourself into that situation i.e. you have jumped in. Alice’s choice of phrase, ‘drawn into the deep’, suggests that nobody had thrown her into this situation, and neither had she jumped in herself, but rather it happened to her and was beyond her control. Hence this choice of phrase seems appropriate, given the circumstances in which Alice found herself, unexpectedly in

the position of working as an unqualified teacher, rather than following her planned route of an employment-based trainee teacher.

Alice describes her identity whilst working at the school as *a teacher,* but in particular, *an unqualified teacher.* She comments, 'that was my job title first' (INT1), referring to the role she had held and how she was recognised in the school community.

The journey to becoming a qualified teacher of mathematics

Influences for becoming a teacher of secondary mathematics

Although Alice had considered alternative careers, she did not pursue these, instead favouring a career in teaching.

> I worked at my sister's company for a bit, sitting behind a desk, and I realised that's not for me and I need to be in front of children. I need to be, you know, interacting… so I think in the back of my mind I always knew that I… want to become a teacher… I just didn't know that it was maths teaching. (INT1)

Alice states that her main reasons for deciding to become a secondary school teacher are first, her 'experience of working with this age group' and second, the impact of 'the teachers I had in secondary school' (PGCE RJ1). Alice also acknowledges the positive influence of her brother-in-law becoming a teacher.

As well as having worked as an unqualified mathematics teacher in a secondary school, Alice has also worked with young people, aged 11-19 years, as a volunteer delivering theology lessons at a Sunday school. This experience has shown her that she 'particularly enjoy[s] educating children' (PERS). Alice also has experience of leading a youth dance group and providing voluntary tutoring in maths. Alice states that her 'numerous experiences in teaching have stimulated me to want to become a

teacher' (PERS) and that she has 'stood in front of children and taught them so I think it's just a natural progression from what I've done before' (INT1).

Both the positive and negative experiences of school teachers, and teaching, influenced Alice's decision to train to teach as a secondary school mathematics teacher. Alice refers to the positive influence of one of her secondary school teachers who 'through his sheer passion and enthusiasm for the subject... inspired me to want to teach' (PERS). Alice also explained that her negative experience with her teachers 'makes me want to become a teacher, because I don't want anybody else to experience that' (INT1) and 'I learned from these experiences that it is vital to develop good relationships with pupils and not negatively label them' (SKE RJ1).

> That is why I decided to become a mathematics teacher so that I could help break the negative stereotype of mathematics. I want to help make mathematics fun and accessible to all. (PGCE RJ1)

The subject knowledge enhancement (SKE) course

Alice notes that 'returning to mathematics as an adult has at times been… hard' but considers that the SKE course 'has been very significant to my mathematical learning' and that she has 'seen great progress' and a 'massive improvement in my mathematical understanding' (SKE RJ3).

> I think a lot of the learning in secondary school is learning to pass an exam, but not necessarily learning for understanding, so the SKE course helped me to understand more than just get the methods memorised. (INT1)

Alice comments that 'overall it has been a great journey for learning' that has given her 'more confidence in mathematics', has helped her 'become more of a mathematical thinker' and has given her 'a great feeling of accomplishment and achievement' (SKE RJ3).

Alice considers one of her greatest challenges in training to be a maths teacher is that she has 'not done a mathematics degree', unlike many of the students on the PGCE course (PGCE RJ1). Despite the challenges, she also notes that having been a recent learner of mathematics puts her in a 'special position' for supporting 'pupils who struggle with mathematics' (PGCE RJ1). She comments that 'this could be advantageous as… I will know how to break down complex topics and explain [them] to students in a way they will understand' (PGCE RJ1). Alice also considers that her degree in Psychology 'has helped me to understand and be familiar with learning, mental and psychological disorders… vital when dealing with SEND students' (PERS).

Alice considers herself to be 'switching' her specialist subject, in training to become a teacher of mathematics. When asked if she considered herself to be *a subject switcher* she replied:

> Definitely… there is maths in Psychology, but it's so completely different… maths has a whole different language to it, a whole different way of thinking. It's completely different, very different. (INT1)

Despite having worked as an unqualified teacher, prior to starting SKE, Alice describes her identity whilst participating in the SKE course as *a student*.

> On the SKE course, I did feel like I was just a student… even the way you dress, coming to the SKE course, you dress casual and you know that showed my identity… because the SKE course was mainly to do with the actual mathematical knowledge… was more like you as a student, do you understand all of the mathematical concepts… during the SKE course I saw myself as a student… I didn't see myself as a teacher. (INT1)

When asked if having completed a mathematics SKE course she now considered herself to be *a mathematics specialist*, Alice replied:

> I think I'm getting there… it wasn't always easy. I'm not going to lie, it wasn't, because doing your Psychology course, being trained in that way of thinking for so long… I feel like in maths I'm going to have to switch and start thinking differently, thinking mathematically, learning the language again. (INT1)

When asked if she felt like *a mathematician*, she replied, 'No sorry [laughs]… yes and no, because I feel like even though I love maths… I don't call myself a mathematician, not really' (INT1).

Alice commented that it is 'vital to have good subject knowledge' for teaching (SKE RJ1) and that 'SKE was like the building blocks to becoming a PGCE student' (INT1).

The Postgraduate Certificate in Education (PGCE) course

On the transition from SKE, to PGCE, Alice refers to a shift in her identity from *a student* to *a professional*:

> I think there has been a shift… I feel more like a professional now as a PGCE student... when you go into school, even if you are just observing, you just feel that you are more formal, you are more professional… more like how you conduct yourself in school… the focus is on your professionalism as a teacher, whereas the SKE course was more like you as a student... so it's quite a shift… in identities as well. (INT1)

Alice describes her professional identities whilst on the PGCE course as *a trainee teacher,* but, drawing on her prior experience of teaching she also describes herself as *a teacher.*

> Currently I feel like I am a trainee teacher… I also feel like a teacher in a way because I've had that experience, I kind of still feel like a teacher, but training to be a maths teacher. (INT1)

She also refers to the differences in her identity as *a teacher,* from working as an unqualified teacher, to being on an initial teacher education course.

> I viewed myself as a teacher but… it's completely different, it's really different to now. There is a big difference between then and now, because I was sort of *drawn into the deep*, not really having any training whatsoever… whereas now I kind of know the difference. (INT1)

Alice considers her identity as *a teacher,* on a teacher training course, to have been influenced by her prior experience of having worked as an unqualified teacher.

> I think I do still feel like I'm a teacher, and I feel like when I'm in the classroom… I think even the kids, the way they relate to me… they perceive me… to be a teacher because the way I… handle myself around the classroom… [they] can tell that I've been there before and that I've had the experience with it, and so I see myself as a teacher, but maybe a trainee maths teacher. (INT1)

Alice's experience of working as an unqualified teacher has provided her with insider experience of the school environment. Alice views her lived experience as a teacher to be an advantage in training to be a teacher on the PGCE course.

> When you start off as a teacher there are a lot of mistakes that you make. I feel that I will avoid a lot of those mistakes because I've seen it before and I know that, okay I've done this and it didn't work, don't do that again, or I did this, it was worthwhile, let me do that again. So I think that's the difference. (INT1)

In particular, she considered that her experience gave her an advantage, over her peers on the PGCE course, who do not have teaching experience.

> When we are in our seminars, all of the questions that other people ask, I… already know the answer to it because I've had experience of it. A lot of them are so worried… what's going to happen when I stand in front of a classroom? What if a student asks me a question that I don't know? I already know the response to it, so I think that has given me a massive advantage others don't have. I know… the school system… I know the school structure, I know how it works. (INT1)

Despite the advantages of Alice's experience, she also considers that there are disadvantages of having been an insider in a school's community of practice.

> Because I've observed the lessons, and been around… that environment, I feel that I've picked up a few bad habits… so I think that is what is hindering me. I have to unlearn those bad habits… especially behaviour management. (INT1)

Future-orientated identities

Regarding her future teaching career, Alice sees her Psychology background as an advantage, as it 'has helped me to understand and be familiar with learning, mental and psychological disorders… vital when dealing with SEND students' (PERS).

> I would like to go into pastoral care because that comes from the Psychology aspect… that comes across from being a youth leader. I deal with a lot of sensitive cases, children in care, children from abusive homes… attendance with the children and trying to help them… even when I was a form tutor for one year, I loved it. I loved my form class and everything… they felt comfortable to tell me their issues. I signposted, and tried to help them as much as possible, I loved encouraging them. I loved doing PSHE. That was one of my favourite bits. So I'd really love to get into the pastoral care. (INT1)

When talking about her future-orientated identities, Alice states that she will become a *qualified teacher* and, in particular, *a qualified mathematics* teacher.

The description of the type of teacher that Alice wants to become draws on both her positive and negative experiences of teachers, during her own schooling, as well as her own background.

> I want to be an inspirational, positive and encouraging teacher. I would like to be a mathematics teacher that genuinely cares about students irrespective of their social economic background. (PGCE RJ1)

There is also a sense of desire to achieve the same positive impact for her pupils that some of her teachers had on her journey.

> Some of the teachers and mentors I had at secondary school have had the biggest impact on my life… their influence in my life is still notable, which I hope to achieve as well. (PGCE RJ1)

On her future-orientated identity, Alice comments, ‘I feel like my identity is going to change when I actually become a teacher’ (INT1).

Appendix 7b: Participant Story Andrew

Andrew is a 35 year old male, who has a Bachelor of Arts degree in Business Management and Information Technology. Andrew has an A-level in statistics and GCSE mathematics. He participated in a 28-week university-based mathematics subject knowledge enhancement (SKE) course, prior to commencing a PGCE course.

Andrew is a career changer who has fourteen years' experience in the customer service sector, including five years as a technical support advisor. Prior to starting an SKE course he spent time observing in secondary school. Andrew is a parent of two young children.

Prior experience

School education

Andrew's 'joy of maths started in primary school' (PERS1) and he describes himself as 'always more interested and drawn to numbers and figures than anything else' (PGCE RJ1). Andrew describes the positive influence of both of his parents 'working within financial sectors while I was growing up' (PGCE RJ1).

> My dad was a financial advisor for nearly 30 years and my mom worked for [name] Bank for 37 years so it's always been numbers and everything have always been there. Well my dad you could give my dad a page of numbers and he'll just – no calculator – add it up. (INT1)
>
> Seeing my father especially have some numbers in front of him, or being given figures and being able to work them out in his head had always fascinated me and I think this is why I loved maths at school so much. (PGCE RJ1)

Andrew describes his first maths teacher as ‘such a good teacher’ who he ‘looked up to’ and ‘always looked forward to his lessons’ (SKE RJ1).

> He was such a good teacher as he always fully engaged with the class and made us all feel welcome as soon as we entered the room… He was able to spot easily if there were areas that anyone was struggling with and was able to give us hints and tips on how to understand these new and sometimes confusing topics. He also made sure that he showed us different ways of coming to the same result, teaching us both the correct mathematical procedure, as well as the easier ways which meant we may be able to recall the information at a later date. (SKE RJ1)

However, later in his schooling Andrew had some negative experiences of learning mathematics.

> I didn’t have the best maths education because the teacher I had was very classical in his style. He was very so this is what we are doing and here’s two examples write them down now do it out of the book in silence and that was every lesson. And I don’t learn like that. I’m a practical learner, I’m a… I can learn through books but I like having things I can do where I can talk and discuss ideas. (INT1)

> Sometimes there was just too much to take in from the lessons and because it was mostly textbook work it wasn’t explained as well as it could have been. I feel that the education that I received was definitely more of a ‘classical’ style it was very textbook orientated and there were not a lot of practical lessons, especially in mathematics, which I personally feel hindered my progress as I am a practical learner. (EDT)

Andrew considers these negative experiences of learning mathematics to have ‘hindered’ his progression in continuing with this subject post-16. Andrew’s highest formal mathematics qualification is GCSE grade B and although he started an A-level mathematics course he did not continue studying this subject, although he did continue with AS-level statistics.

> So I think that hindered me a little bit and that’s why I didn’t, well I did go on to do A-level maths, but got told after the first… term not to carry on doing it all, because I would fail, and just to focus on statistics because I was doing

> better at statistics. And that's why I never carried on maths into university or anything. (INT1)

As Andrew moved through secondary school he focused more on 'Business and especially the management side of things' (PGCE RJ1), this subsequently being the focus of his undergraduate studies.

Subject specialism

Andrew is a graduate of Business Management and Information Technology, he has an A-level in statistics and GCSE mathematics. Andrew participated in a university-based, 28-week subject knowledge enhancement (SKE) course in mathematics prior to commencing a PGCE course.

Andrew notes the mathematics content of his studies in Business:

> Business had sides of maths, it had finance and economics in it… and in my first year of university I did marketing as well which obviously had a lot of statistics, demographics and stuff. (INT1)

When he decided to train as a teacher of mathematics, Andrew completed 'an SKE to improve and enhance my subject knowledge' (PGCE RJ1).

Vocational experience

Andrew had struggled to decide on a career, stating 'I did not have any kind of idea what I wanted to be when I was older' (PGCE RJ1). As a teenager, he 'got into the idea of wanting to be an accountant' and attributes this interest to his 'parents both working in financial sectors' while he was growing up (PGCE RJ1). However, after one week's work experience with an accountancy firm he 'realised that it really was not for me at all' (PGCE RJ1).

Andrew focused on 'Business and especially the management side of things' and after successfully graduating with a Bachelor of Arts in Business Management and

Information Technology, he found himself ‘moving from job to job, trying to find my place in life and within the work place’ (PGCE RJ1). When Andrew became a father for the first time his focus changed to ‘finding a stable career to be able to provide for my child’ (PGCE RJ1). Andrew considered ‘becoming a teacher’ (PGCE RJ1) over ten years ago and states that ‘teaching has been a dream for a long time’ (PERS).

> I then eventually found my place within the world of telecommunications, specifically within the customer service sector, I found this sort of work extremely rewarding and enjoyable as I knew I was helping people every day… especially when I moved to the world of technical support. (PGCE RJ1)

Andrew stayed in the technical support advisor role for over five years before he ‘had to move back home and leave my job’, as he became a father for the second time (PGCE RJ1). Andrew ‘once again, drifted from job to job’ until again considering teaching as a career, ‘completing an SKE to improve and enhance my subject knowledge’ (PGCE RJ1).

Andrew considers that the ‘empathy and patience’, ‘people skills’ and ‘ability to communicate’ that he developed during his time working in customer services are transferable and that he can ‘adapt’ these to working with young people (PGCE RJ1).

> I was teaching people in a way, explaining how to use their phones and opening their eyes to different things and ways they can do things with their phones, so I guess this, combined with the people skills I learnt while doing this, will be something that is invaluable to have when I move into the classroom. (PGCE RJ1)

The journey to becoming a qualified teacher of secondary mathematics

Influences for becoming a secondary mathematics teacher

Andrew states that ‘teaching has been a dream for a long time’ and that now he is in the ‘right position to be ready for this challenge’ (PERS).

> Becoming a teacher is something I wanted to do many years ago, and due to many factors it was something I never pursued. Now I have regained my drive to achieve this, not only as a personal goal but to be able to help and develop the next generation and give them as much of a good start and ongoing education as possible. (SKE RJ4)

Andrew refers to the positive influence of his own teachers as a ‘big factor’ (PGCE RJ1).

> Another big factor was my first ever maths teacher at high school… I would always be looking forward to his lesson every week he had the ability to make even the most mundane subject seem to be the most interesting. (PGCE RJ1)
>
> I had some really good teachers… that I still remember like now. My year 7 maths teacher was fantastic and I can remember his lessons and that’s what I want to be… I want to be something that 15-20 years after leaving school I want kids to be like I remember my maths teacher that that’s how I want to be. (INT1)
>
> Teachers like this are what have made me want to go into teaching, as I would love for someone in 15-20 years to be writing the same sort of thing about me. To be able to influence someone’s school life so much that they remember you so long after leaving school would be something I would be immensely proud of. (SKE RJ1)

He also refers to negative experiences of learning mathematics:

> I didn’t have the best maths education because the teacher I had was very classical in his style… he was very…, so this is what we are doing, and here’s two examples, write them down…, now do it out of the book..., in silence, and that was every lesson. And I don’t learn like that. I’m a practical learner…, I can learn through books but I like having things I can do, where I can talk and discuss ideas. So I think that hindered me a little bit. (INT1)

Andrew considers his experience of having struggled with some aspects of maths will help him as a teacher:

> I do remember that when I was at school I did struggle with some of these subjects at the time. I know how this felt, when I was at school, and so I want to be able to help people in the future if they struggle with this subject, to try and help them to grasp the concept, so they don't struggle the way I did. I feel that being able to overcome my own misgivings and the things I have struggled with in the past, I can better teach these subjects, as I have a better understanding and appreciation of the difficulties that can be faced with these. (SKE RJ3)

Andrew draws on his 'extensive work in customer service' (PERS) and his prior experience of supporting new colleagues as a positive influence in deciding to train as a teacher.

> I was very much a people person… because of the jobs I did… all of that was customer service… I had to have a lot of empathy with people… all face to face, it's all polite work, polite all the time, smiling… building that rapport, and if you can build that with somebody… especially in the classroom that's going to build quicker… [it would] be a really good skill to have. (INT1)

> I have developed both empathy and patience during my extensive work in customer service… This has allowed me to greatly develop my people skills and ability to communicate with people of different backgrounds, ages and abilities meaning I can apply this to dealing with young people. (PERS)

> In the roles I was doing, where I was in customer service, or working in the call centre, especially when new members of staff came in, I was always the one to say I'll help. If they needed to sit by somebody or they needed training, whatever. I don't mind helping. Even working in the pizza shop was the same, like you get new drivers come in and they have to go with a driver for a bit, so they'd… come in my car with me and I'd show them the ropes and everything. So even then it was, obviously it's not the same as teaching a class, but it's still teaching. (INT1)

> I was teaching people in a way, explaining how to use their phones and opening their eyes to different things and ways they can do things with their phones, so I guess this, combined with the people skills I learnt while doing this, will be something that is invaluable to have when I move into the classroom. (PGCE RJ1)

Through Andrew's prior experience of working with Beaver Scouts he says, 'I realised that I liked being around kids. They're funny… they are the most interesting

people' (INT1). He also states that becoming a teacher will 'help with my kids as well' (INT1).

> I like teaching my daughter… she's three and a half and she's at nursery and she's got these things that she plays with where they are just plastic shapes and they've got magnets and they stick together. And while she's playing with them I'm like, what shape is this? How many sides has it got? So I'm getting her now and… getting her to learn as many shapes as I can, just getting everything to sink in. (INT1)

Whilst Andrew states extrinsic motivations of 'finding a stable career to provide for my child' (PGCE RJ1) he also has intrinsic and altruistic motivations for becoming a teacher.

> I feel that by becoming a teacher I can pass on my knowledge and experiences to young learners as my teachers did for me. I want to teach to not only better myself but to be able to enrich school children's lives and learning experience. (PERS)

The subject knowledge enhancement (SKE) course

In his reflective journal entries, Andrew refers to 'enjoying the maths SKE' (SKE RJ2) and views the SKE course positively as improving and enhancing his subject knowledge.

> It has helped me to see where the major gaps are within my knowledge but has also helped me to realise that I in fact still know a lot more than I thought and had remembered a lot more of what I was taught in school. (SKE RJ2)

> I feel that during this SKE course my learning and knowledge has grown dramatically, I had a base knowledge of some key factors and processes that are required in mathematics, but I had forgotten a lot of them since I was at school… My attitude towards teaching has altered a huge amount since I started this course, don't get me wrong I knew it was going to be a lot of work before I started, and it comes as no shock seeing just the amount of work we are currently doing just to get our knowledge at a level where it needs to be. (SKE RJ4)

Given his experiences on SKE, Andrew recognises that doing more of 'why we do things or why things in mathematics work' may help pupils 'to grasp the individual ideas, and even grasp new concepts quicker' (SKE RJ4).

Andrew comments that he 'can't wait to continue on this journey and gain more knowledge and skills which will hopefully and ultimately lead me to being the best teacher that I can possibly be' (SKE RJ2).

When asked if he considers himself to be *a subject switcher* Andrew replied, 'I suppose I would, yeah, because… I haven't sat at home and just sat there and done pages of sums and stuff' (INT1).

When asked if he considers himself to *be a mathematician* or *a mathematics specialist* Andrew replies:

> Um not really, as I say, it's not something I considered even looking at doing at university. The A-level it was because I needed to do something. I actually did A-level maths because it fitted around the GNVQ that I was doing. Otherwise I probably would have done History but they were at the same time. So no, I wouldn't consider myself a maths specialist… a mathematician. I suppose I am a mathematician because I like maths not a mathematician or a specialist, like some of the people I hear about who've done a maths degree and things like that. (INT1)

Andrew refers to his identity whilst doing the SKE as *a maths trainee or a maths student.*

> I suppose that I was just a trainee in like a maths trainee… I suppose a little bit of a student as well. I would say maths student because you are focusing on one specific subject and getting better at that subject. (INT1)

The Postgraduate Certificate in Education (PGCE) course

Andrew refers to his identity on the PGCE course as *a trainee teacher* rather than *a student.* He explains the difference from being an undergraduate student.

> Not so much as a student, because I see that as an undergrad, because that's the going out, drinking a lot, leaving everything until the last minute, which I did… I suppose trainee teacher is where I see myself. People ask… if they ask[ed] me what I was doing, I'm a trainee teacher, it's not I'm going to university, it's I'm a trainee teacher. (INT1)

He also explains the difference to being on the SKE course, 'whereas doing this now as a PGCE… you are focusing on becoming a teacher, but… it's everything that's why it's more of a trainee than a student (INT1).

Andrew refers to his identity of being a mature participant on the PGCE course as 'well I know I'm the oldest, well in maths anyway I'm the oldest. It makes me feel old when I say I graduated university… and they are like, I hadn't even started school. I feel old... I think I'm the awkward one' (INT1).

As a mature career changer with extensive prior work experience, Andrew states 'just chuck me in at the deep end' (INT1). By using this phrase Andrew indicates that he is keen to get into school and get on with teaching.

> I'm like, just let me, just chuck me in, just let me go. If I fall flat on my face, I fall flat on my face. I'll pick myself up, dust myself off. Tell me where I've gone wrong and I'll do it better. I think that's a better way of doing things, especially because if you've got ideas yourself of what you want to do, and how you want to teach, and you sit and watch the same teachers over and over again, you are going to start picking up all of their things, and maybe lose some of your own things, which would in effect you'd be losing part of your teacher identity and picking up somebody else's or copying it. (INT1)

Future-orientated identities

Andrew describes his future-orientated aspiration as 'I don't want to be a good maths teacher. I want to be a good teacher… I'd rather be a teacher that specialises in maths, not a maths teacher' (INT1).

Andrew describes the type of teacher he aspires to be:

> I want to be the kind of teacher that can spot people's skills and weaknesses and obviously get them to overcome their weaknesses but make sure that they are not just working to their level. I want to be the sort of teacher that pushes everyone that's capable past where they should be, to get the most… because that's what I didn't have at school and that's what I think everyone should get. (INT1)

Andrew hopes to 'be like the exemplary teacher… and have pupils remember me and my lessons for years to come' (SKE RJ1).

> Teachers like this are what have made me want to go into teaching, as I would love for someone in 15-20 years to be writing the same sort of thing about me. To be able to influence someone's school life so much that they remember you so long after leaving school would be something I would be immensely proud of. (SKE RJ1)

> To be that memorable a teacher… is something I would love to be in the future, for pupils to remember me 24 years after I've taught them, that would mean I have left a lasting impression on them. (PGCE RJ1)

Appendix 7c: Participant Story Christine

Christine is a 25 year old female who was educated in India until she moved to England at the age of 18. Christine has a Bachelor of Arts degree in Business Management and participated in a 28-week university-based subject knowledge enhancement (SKE) course, prior to commencing her PGCE course. Her highest formal mathematics qualification is equivalent to GCSE level.

Christine undertook part-time work as a sales assistant, in a furniture shop, whilst she was at university. Prior to starting her SKE course, she spent four weeks in a voluntary capacity in two different secondary schools in England.

Prior experience

School education

Christine was educated in India until the age of 18 when she migrated to England.

Having 'always enjoyed mathematics' (PERS), Christine wished to pursue this subject at post-16 but explains that she 'did Business just because I couldn't, at that time, I couldn't do maths but always wanted to do maths' (INT1). Christine explains the reasons why she could not continue studying maths beyond GCSE level.

> My secondary education it was in India but then my parents migrated to this country so I had to ─ in India ─ I had to move to another state in a boarding school and that boarding school was extremely different to the one I went to where I did my secondary education. So for my senior education I wanted to do maths [but] it was non-medical… [a] stream which includes mathematics, physics and chemistry. I choose those when I entered the school but however when I saw their curriculum because that was a private school and the curriculum was extremely different to the one I'd been to because I was in a government school therefore I couldn't cope with it because there's some like you couldn't… like logarithms and… matrices we've done we would do that in year 12 in our A-levels whereas they've already done in GCSE. So I couldn't do that then because I have no like basics… therefore I had to

> change it to Business Management because Business Management was new, it was starting from scratch, so I could do that whereas not with maths so therefore I had to choose Business Management. So I did two years of Business Management there so that's why when I migrated to this country… that's why I pursued this. (INT1)

Subject specialism

Christine is a graduate in Business Management and her highest formal mathematics qualification is equivalent to GCSE level. Christine participated in a 28-week university-based subject knowledge enhancement (SKE) course in mathematics, prior to commencing her PGCE course.

Vocational experience

Christine had some part-time experience of working in retail, whilst she was a student, and considers that she has acquired skills that are transferrable to teaching.

> I've been a sales assistant. I've done part-time work in a furniture shop. So… improving my communication skills, maybe you could say interacting with people, because I think I could take that to my profession as well because there's going to be much communication amongst colleagues or with the pupils as well. Communication, interaction, engagement ─ those kind of skills I think I've got. (INT1)

Having started SKE and PGCE immediately after completing her degree, Christine has not had an alternative career and did not consider careers other than teaching, as she has 'been very passionate about teaching and education from a young age' and her 'dream is to become a teacher' (PGCE RJ1).

Christine spent four weeks in two different secondary schools, prior to starting her initial teacher education, and describes how this experience supported her understanding of schools in England.

> It was good to know like schools, how schools work here… to know different behaviour policies as well because like we've never ─ in my country ─ we've never had behaviour issues because like we do like you never you can't

> argue with your teachers. That's the main aim like main agenda of the schools as well. Whereas here there were quite a lot of behaviour issues it was good to know to see the difference and the education system how the classes work. Because I didn't know what forms are, what year groups are, and to compare it to the country where I've come from it was good to see that kind of comparison and differences… The other thing I noticed was there is a lot of responsibility on the part of a teacher whereas in India there is more responsibility on the part of a student than the teacher… So they've got more roles to play. So that's good to see. And another thing, like creative elements side of the thing as well, like in India there is less creativity and more, like, just giving information and teacher-led classes, whereas here they prefer more engagement and creativity. And another thing was… to be with the people in need here like the schools where I've been. The schools where I've been to in India I haven't seen anyone like any of the special needs like or to see how to cope like. Whereas here, when I came here, I saw that as well and then learned how to deal with that kind of person... it was interesting to see that as well, like, people from different cultures and different backgrounds. (INT1)

This experience helped Christine to confirm that 'I want to go and pursue this career' (INT1).

The journey to becoming a qualified teacher of secondary mathematics

Influences for becoming a secondary teacher of mathematics

On continuing with Business Management for her undergraduate studies, Christine notes that 'when I came to this country… no one was here to help me. My parents weren't that educated, so nobody was there to give me support or [help me] to know which way to go' (INT1). However, Christine later learned that she could still pursue a career teaching mathematics with her degree in Business Management. Christine notes the positive influence of her husband on her journey to becoming a mathematics teacher.

> I got married… and then my husband, he told me about various education paths and he told me that you could go into teaching. You still could pursue your career, even with your Business Management degrees, because there's certain options, so then I thought about it, yeah, because I wanted to do this

> in India, but due to some certain circumstances I couldn't, so therefore I did the SKE course… to polish my knowledge and here I am now doing… Because we've got our own business I could have just helped my husband. But he doesn't want me to be in that career either like in business. He just wants me to be on my own feet so I want to be in this teaching career as well, especially just teaching maths. (INT1)

Christine undertook four weeks voluntary experience in schools in England prior to commencing her SKE and PGCE courses. She notes that this experience helped confirm that 'I want to go and pursue this career' (INT1).

> The reason that I did those experiences before SKE was for myself... just to see if I would be able to cope with it… is that the right decision I'm taking, to go into this career? So it kind of confirmed it and helped me to take my decision. (INT1)

Christine describes her motivation for a career in teaching.

> In my family no one is that educated because of… you could say the financial conditions or maybe our… background so I wanted to be, like, to be in a profession, like, which is really good and [in] which I can set an example for my future generation as well. (INT1)

The subject knowledge enhancement (SKE) course

Christine says, of the impact of taking a SKE course, 'otherwise… I wouldn't have been in this journey. I couldn't be a teacher… because that's main thing, you need to do that before going for teaching' (INT1).

Despite recognising the importance of SKE to her journey, Christine does not consider herself to be switching her specialist subject by training to become a teacher of mathematics. When asked if she considered herself to be *a subject switcher* she replied, 'No I wouldn't say that. It was because of some circumstances that I had to change my course, change my subject, but I always wanted to do this' (INT1).

Christine describes her identity whilst participating in the SKE course as *a learner* and in particular, *a subject learner* or '*a learner of subject knowledge*' (INT1).

On being *a mathematician*, Christine states, 'everybody says mathematician but I… don't think that I'm a proper mathematician yet' (INT1).

The Postgraduate Certificate in Education (PGCE) course

On the PGCE course, Christine still refers to herself as *a learner* but notes the difference between being a learner on the SKE course and a learner on the PGCE course; 'On SKE I was a subject learner, but here [points at PGCE on ACT2], as a person, I'm improving myself to go to this… field' (INT1).

> I think I was a learner there as well [points to SKE] but kind of like at that time my subject knowledge, I didn't have that much of subject knowledge at that time, whereas here [points to PGCE] at this point I've kind of filled that block of my subject knowledge. I'm a learner in a way, I was learning the subject here [points to SKE on ACT2], but here [points to PGCE] I'm learning now how to deal with students, or how to, I mean teach... I'm a learner in both boxes [points to SKE and PGCE boxes]. (INT1)

On starting the PGCE, Christine refers to an immediate shift in her identity from *a student* to *a professional*.

> In doing this course, when we came here on the first day, you're not students now you are entering the profession… like, it feels proud as well. Like, this teaching career is really good like, you all are teachers now. You are learning to be a teacher. You're not students any more. Whereas when I did this degree we were all just, like, normal undergraduate students. (INT1)

Early in the PGCE course, Christine does not yet view herself as a teacher because she has not yet started her placement in school and is not in the school community of practice.

> Teacher?: I don't know, like, until I… go there to the schools and… because we've been to two day placements still, like, you don't get to until you… go and speak to the students and be with them you can't really tell. (INT1)

Christine does however refer to herself as *a trainee teacher;* 'I can say I'm a trainee teacher, yeah… learning to be a teacher' (INT1).

Future-orientated Identities

When talking about her future-orientated identities, Christine states 'a maths teacher with good subject knowledge' (ACT2), bringing together being 'a learner of subject knowledge' on the SKE and 'learning to be a teacher' on the PGCE (INT1).

Christine indicates a desire to continue to enhance her subject knowledge for teaching.

> At the moment I am only focussing on teaching GCSE, because my knowledge is only, I think up to… I could only be very confident to teach GCSE, not A-level. So I might in future ─ would want to ─ I mean go back to learning or… doing [a] maths degree or wherever I can teach higher stuff. That's what I would like to do. (INT1)

Christine's future-orientated aspiration is 'to become a proper mathematician' as 'even… if I'm called a mathematics teacher I don't think I will be a proper mathematician' (INT1).

Appendix 7d: Participant Story Deborah

Deborah is a 28 year old female who has a Bachelor of Arts degree and a Master of Arts degree in Politics and participated in a 28-week online subject knowledge enhancement (SKE) course, prior to commencing a PGCE course. Her highest formal mathematics qualification is AS-level.

Deborah undertook part-time work in shops and cafés while she was a student. Following the completion of her Master's degree, Deborah completed a management training scheme with a well-known supermarket chain. Deborah worked as a department manager in the retail industry for over five years before retraining to become a mathematics teacher.

Prior experience

School education

Deborah describes herself as having 'a challenging background' (PGCE RJ1) and 'coming from a family of limited resources' (PERS).

> We lived in a little council house and didn't have a family car until I was 14. Our lack of transport has surprising conclusions such as being unable to learn to swim as there were no swimming pools within an affordable reach. (EDT)

In considering her own educational timeline, 'the factor that most influenced my time in education was the investment in the school system including the education maintenance allowance, free school meals and maintenance grants' (EDT).

Deborah has 'always liked maths' (INT1) and comments that it was 'one of my favourite subjects in school' (PERS). She describes herself as having always 'been classed as like a STEM student… I was always doing science and maths' and 'up

until the age of seventeen I would have defined myself as ‘mathsy – sciencey’’ and had ‘always wanted to be a pharmacist’ (INT1)

Deborah was entered to take GCSE maths early in Year 10.

> We sort of got assessed in year 8 and there was about fifteen to twenty of us who… did our GCSE in a year and did an additional maths course… we did statistics GCSE as well… we were really pushed and really like challenged… So we did GCSE in a condensed year and then did the additional maths (INT1)

Deborah opted to study mathematics post-16 but comments that:

> When I went to do A-level maths I really struggled because the teaching just like really changed… it definitely was a step up and reflecting back on it I didn’t enjoy the teaching sort of styles in A-level. (INT1)

Deborah described her experience of being taught mathematics at A-level:

> I really enjoyed maths but I felt that [I] got left behind in A-level, the subject matter really stepped up and we changed teacher to a more senior mathematician. This was great for some of the students who were naturally gifted but I found myself frustrated ─ awestruck by witnessing a great mathematician narrate problems but definitely lacking the support of a great teacher. (PGCE RJ1)

> He’s a really good mathematician and I could watch him and be really interested and then I couldn’t put it together in what I was doing and he didn’t… wasn’t very good at communicating that and so… there were a few of us that were like really trying but getting nowhere and with A-level maths if you haven’t got the underpinning concepts you can’t kind of go anywhere with it. (INT1)

Reflecting on her experience of studying additional maths she states, ‘I don’t think doing additional maths in between helped because I quickly switched off from that because there were bits that were too difficult and I don’t think that helped’ (INT1).

> I think we were designed to do that additional maths course that’s why we did the GCSE in a year but the additional maths course is like… C1 and C2 and some of it is… further pure 3 and 4. It was meant to be interesting and that was kind of meant to get you through… I did further maths as well and I

> enjoyed it and I enjoyed the classes but I didn't achieve… I think I got a U in further maths and, um, I dropped it in A2 level. (INT1)

After completing her A-level studies, Deborah studied 'Politics at university which is what I got my grade A in… really enjoyed it and then that's what I did my Masters in' (INT1).

> Politics was offered as an A-level and I'd always been interested in that and always been a bit like a social activist. I come from quite a challenging background, a single parent family and housing estate, so it's always been something that's motivated me but I think if I was to do it again… do it backwards as you know better when you are an adult and stuff, I think I probably would have retaken my first AS and proceeded with that and done maths and sciences and stuff because it's what I've always really enjoyed from a really young age… Not that I'd never shown any interest in politics but I just can't imagine picking a subject at degree… and I went to study a subject that I loved with no idea of what I wanted to do afterwards, and did my Masters self-funded with no idea of what I'd do after it. Before that I'd always wanted to be a pharmacist. I'd done two years' work experience because it was relatively competitive and you had to have experience. I can't even put into… can't even pinpoint what exactly went wrong. I don't know. (INT1)

Subject specialism

Deborah has a Bachelor's degree and a Master's degree in Politics and her highest formal mathematics qualification is AS-level. Deborah participated in a 28-week online subject knowledge enhancement (SKE) course in mathematics, prior to commencing her PGCE course.

Vocational experience

Deborah 'had part-time jobs since I was sixteen. So I've worked in chip shops, cafes, that kind of thing' (INT1). Having to self-fund her Master's degree she 'worked three jobs. I worked still in the chippy. I worked as a coffee barista and I worked in [name of supermarket chain] as a part-time colleague in a petrol station' (INT1).

Following the completion of her Master's degree Deborah started a 'fast track management scheme' with the supermarket chain she had been working for as a student and became a 'department manager within three months' (INT1). Deborah has substantial experience of working in retail and for over five years was employed as a department manager.

> Whilst studying I worked to fund my education; one of my jobs was at [name of retail company]. When I graduated they offered me their managerial training programme. They recognised my interest for learning and believed that I had the capability for rapid progression. I completed my training to be a department manager in 3 months by really pushing myself, working with my peers and driving my own development. I was soon moved onto a challenging department: Counters, which includes butchery and fishmonger skills. I was selected for this department because of my high standards, attention to detail and my ability to manage more than one area effectively. (PERS)

Deborah completed the one year management training programme in three months and describes this as 'chomping at the bit… where I want to get and do something… I'm at my best when I'm being pushed' (INT1). Deborah undertook 'training the trainer and facilitating workshops' (INT1) training and enjoyed this aspect of her work. Deborah refers to the satisfaction she experienced from training colleagues to be one of her motivations for 'consider[ing] teaching as a career' (PERS).

> There are many physical skills required on counters which I teach colleagues, I took extra courses about delivering behavioural and technical training. When I taught colleagues skills they had never done before I found myself truly motivated and animated by their successes. Being able to celebrate success with the colleagues I have taught is one of my greatest achievements. It was this that made me consider teaching as a career. (PERS)

Deborah refers to her department manager role as dealing with 'similar sort of stuff as what pastoral teaching is except that they are a little bit older, you get the sixteen and onwards' (INT1).

Regarding her future-orientated aspirations and identities, whilst in retail management, she 'did a lot of senior management training… with a view to being a store manager' (INT1).

The journey to becoming a qualified teacher of mathematics

Influences for becoming a teacher of secondary mathematics

Deborah stated that she 'never wanted to be a teacher, it's not something I wanted to do when I was growing up or anything' (INT1).

> I wanted to be a pharmacist when I was at school. That was what I wanted to do. So I took maths, chemistry, biology and politics. Politics was like something that I enjoyed… so almost like a light relief [laughs]. (INT1)

Despite her original ambitions, her interest in politics led her to completing a Bachelor of Arts and a Masters of Arts in this subject, funding herself to take the Master's degree through part-time employment. Deborah's part-time work for a supermarket led to her being offered a place on a fast-track management training scheme and taking up employment as a department manager. Deborah 'enjoyed that every day was different' and 'loved the unpredictability of' this work (INT1) but describes other people's negative perceptions of her chosen career and changes in the industry.

> So I'd been there for a few years and as I was starting to see people and they were like okay obviously you went to university and then you spent ages funding your own Masters by working six days a week to then go and work in a shop. (INT1)
>
> The industry is changing really rapidly and it... the expectation changed. So you can have an amazing six months and you can be the best thing since sliced bread… but then you can have a bad visit from a regional manager that's not really your fault, like you've had a bad day off or something and the pressure is really bizarre like… and then you feel like you're doing a really

> bad job… and it's quite up and down. Like I was working… I never took any holidays… I haven't been abroad for… ten years… I didn't really take any time off. (INT1)

Changes in the retail industry, a growing disillusionment with her career in retail management and a desire to 'do something that's got more value to it' led to Deborah to start 'looking for other things that I could do with my degree and what I kind of wanted to do' (INT1).

> [I] looked into going into training or HR management and that kind of... I didn't like where it ended up being sometimes as a HR manager you were just employing policies and I didn't want to make loads of people redundant for the rest of my life… so I looked at training… and then I looked at the getting into teaching and all the adverts were on and whatever. (INT1)

Deborah draws on her prior experience of training colleagues, as someone involved in 'training the trainer and facilitating workshops' (INT1) as a manager as a positive influence in deciding to retrain as a teacher.

> There are many physical skills required on Counters which I teach colleagues. I took extra courses about delivering behavioural and technical training. When I taught colleagues skills they had never done before I found myself truly motivated and animated by their successes. Being able to celebrate success with the colleagues I have taught is one of my greatest achievements. It was this that made me consider teaching as a career. (PERS)

Having friends who are teachers is cited as having a positive influence on Deborah's decision to train to become a teacher. 'I've got friends who were teachers who really like what they do'

> You'd see on the news every day that people are leaving the profession and everything… but all of my friends who were teachers were, like, saying people that applied to be teachers enjoy teaching people but there is, like, these underpinning things such as, like, organisational skills and stuff that you may actually really like teaching and be a really great teacher but if you don't have those things you are never going to be able to kind of balance the workload and that kind of thing. Whereas if you do have those skills… (INT1)

> I know a lot of people who teach and I never thought that that mattered… when you kind of spend that much time around them you… it's a kind of in club and teachers marry teachers and stuff… you kind of get sucked in when you know a lot of people that are teachers. (INT1)

On choosing secondary school teaching, Deborah comments:

> When I thought about going into teaching there was no question… Secondary school is the place where you start to become who you are going to be forever. You develop opinions, beliefs and strengths at an age where they can all still change. I think working with young adults at that time of their life is fantastic, being able to mentor and facilitate them in the search for education, both academic and personal. In my previous career as a manager for a retailer I worked with many young adults around ages of 16/17/18 and working with them and training them made me want to go into teaching. (PGCE RJ1)

On choosing to teach mathematics, Deborah explains:

> There is a really good sense of self-esteem and it reminded me of when I used to teach people at [name of supermarket chain], like, sixteen year olds with really long nails, massive eyelashes and I'm, like, right you've got a fillet salmon and it's Christmas time and you've got to… and it's, like, yuck I don't even want to touch it because it's got eyes and everything… and then the first time they do it they are so proud of what they've done and if… if you could show them back what they were like when they didn't even want to think about it but they… they come and find me and they are, like, 'you'll never believe what I've just done' and even though they know that I know they'll be, like, so excited and maths was like that. So you'd start completing the square and people would be, like, yuck and I know how to solve a quadratic equation why do I have to do this and then the first time that they get it right… or the third time or when they see a complicated one they're, like, 'Miss come and look at this' and I love it… that kind of feeling of being able to put that together and I couldn't… I didn't find any other sort of subject that I found that in. (INT1)

Deborah also notes the influence of perceptions of mathematics in society.

> Mathematics is such a divisive subject, you meet people everywhere that say things like 'I hate maths', 'I was never any good at maths', 'I just didn't get it' and as they move through life they see how much of a disadvantage that can be. In my previous role as a manager at a retail company I worked with many young people who were really frustrated to be still resitting GCSE maths or even having to proceed to 'functional maths' courses. I think sometimes we

> don’t provide enough context for students in maths which gives them license to switch off. (PGCE RJ1)

Deborah identifies her varying experience of teachers when she was at school and how this has influenced the type of teacher she would like to become.

> I will remember some of my iconic teachers for the rest of my life; I remember wanting to tell them what I had achieved and how it made me feel. That is the relationship I have with my colleagues now: they come to me when they are proud, unhappy or in need. I believe that as a maths teacher I could really make a difference and support my students. (PERS)

> I had… one teacher from year 7 to the end of GCSE. She was incredibly supportive and consistent with her approach, working with [name of teacher] that made me realise the importance of great maths teachers and she inspired me to want to continue with that. (PGCE RJ1)

> I didn't always have great maths teachers, often I had people that were just great at maths, not strong communicators or people that were truly engaged and I could see and feel students mentally dropping out of maths. I know that I can inspire a passion and interest in maths. (PERS)

The subject knowledge enhancement (SKE) course

Deborah studied an SKE course online prior to commencing her PGCE course. As a career changer, the online SKE course allowed Deborah to continue working full-time while taking the course.

> I worked early mornings, I worked late nights ─ when I was baking I was working over night as well ─ so it meant that I could do a little bit whenever I wanted. I could do two hours a night or I could do a whole day on a Sunday. (INT1)

Deborah refers to the SKE course as ‘really valuable’ and ‘one of the best things that I’ve done’ and comments that she ‘would really recommend it. I wouldn’t have been prepared to come in September having not done something that good’ (INT1).

When asked if she considered herself to be *a subject switcher*, Deborah replied, 'I suppose so because my interest is so heavily in maths, especially currently, I… yeah, I suppose so which is a real shame because I really enjoyed what I did (INT1).

Deborah refers to herself as '*a non-mathematician*' and when asked if she considers herself to be *a mathematics specialist*, she replies, 'probably not' (INT1) but indicates that she may view herself as such in the future.

> I'm a bit like, I like maths I find it really interesting and… but I would feel uncomfortable or sort of like… even to the extent when [my partner's] friends are all obviously engineers and when they all did degrees in maths and they've gone on to be engineers… I would sort of say there is a divide because I feel that they, I feel like I'd be taking something away from them to describe myself as, like, a mathematician although I definitely feel like… the interest in it… but I think if you ask me in two years' time I think I probably will feel like that because I do enjoy it. (INT1)

Deborah describes her identity whilst doing the SKE course as *a student* and she considers herself to still be *a maths learner* (INT1).

> I guess really I just felt like a student… but a more proactive student because I really wanted to do it… and I was really keen to do it and I was really keen to ask questions and definitely in the learning phase. I didn't sort of see it as a means to an end which is quite interesting because I thought that I would feel like that… but when all the information turned up I was… I wasn't doing it so that I could turn up here in September. I was doing it because I wanted to do it and I think if I had of walked in in September and I hadn't have liked it or if I'd gone on my two day placement and hated it and I hadn't liked it I wouldn't have regretted doing the SKE, even though it was a lot of hard work on top of working full-time. (INT1)

The Postgraduate Certificate in Education (PGCE) course

Deborah comments on being *a non-mathematician* in a cohort of mathematics graduates.

> There are a lot of maths graduates. There are only I think four of us who haven't got a maths degree and out of those four they all did the SKE here… they did a long one coming in a couple of times a week and so that kind of

> shook my confidence a bit… but when you learn as an adult you kind of become more accepting of not knowing things. Because I relearned stuff in the last sort of two years, year and a half, I'm not bothered about asking questions or if I've got something wrong then I accept it a little bit easier, whereas some of the guys who've done a maths degree, if they've got it wrong they don't like it or they kind of go oh I don't want to teach it like that or I don't like that explanation or whatever. (INT1)

Deborah describes her identity on the PGCE course as *a trainee teacher* rather than *a student* and explains that having had a previous career influences this compared to those on the PGCE course who are not career changers.

> It's a different… it's a very different… when you've done sort of been a student it's a very different experience to being a student and I see that not all of the people have made that mental leap. Some of the guys have gone from school, to degree, from degree to PGCE. They don't… they haven't… they still treat it like a student… whereas I don't… I don't feel like a student. I feel like a trainee teacher. I feel like I'm… almost similar to my departmental manager training. There are things that you've got to do. (INT1)

Future-orientated identities

Deborah's future-orientated identities draw on her prior subject and career expertise. Despite her shift to mathematics, Deborah still holds a potential place for her prior subject specialism, Politics, in her future teaching career.

> I was saying to my mentor yesterday… if you do A-level Politics I'll go in because if I could draw up an ideal job I'd love to be able to teach maths and maybe do Politics with the A-level in the school 'cos that would be ideal. (INT1)

Deborah's future-orientated aspiration is 'to develop into a head of subject and potentially one day be an assistant head teacher' (PGCE RJ1). Deborah explains how this brings together her prior identity as a manager and her current identity as a trainee teacher.

> Long term I would like to be in senior management in schools and I think that marries the two things together [points to prior identities and current identities on ACT2] because I'm under no illusion that I'm going to get paid less money as a teacher. At least in the first place I think… so that's pretty scary… because I'm very money driven… I like to have a nice car, I've got a mortgage as well… but I think that I need to do something that's got more value to it but I enjoyed leading and managing people and pushing people's personal development and stuff because that's something that I enjoy myself… so I suppose, maybe not in a years' time but in two years' time, I'd be wanting to look towards changing… being able to change… I can change things that are in my classroom next year but then thereafter maths lead or in the leadership team of the school. I want to go in that area. (INT1)

Drawing on her own background and experience, Deborah comments on the type of teacher that she would like to be and on the difference that she would like to make to pupils' experience of learning mathematics.

> Having done my PGCE, I feel so much more passionately about how mathematics is taught and how I suppose [I] got left behind… and I didn't even really get left behind, like, I got A-level, I got my GCSE at a good grade… I'm competent… and then you see people still at nineteen doing... redoing their maths and doing functional maths and really struggling with it because something went wrong. (INT1)

> I have always been keen to make a difference and give everyone a fair chance in life. I was lucky enough to go to a great school and despite coming from a family with limited resources I was able to experience new and exciting things, from Duke of Edinburgh trips to seeing theatre… I believe that as a maths teacher I could really make a difference and support my students… inspire a passion and interest in maths. (PERS)

> I have a challenging background and I have achieved many of my dreams. I want my students to believe they are capable of anything they want, too. (PGCE RJ1)